Wm. M. Man

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PSYCHE

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SOME NOTES ON CERCYON, WITH DESCRIPTIONS OF THREE NEW SPECIES.

By H. C. Fall.

Tyngsboro, Mass.

Some recent correspondence with Mr. Chas. Liebeck of Philadelphia has led to a critical exmaination of certain of our species of Cercyon, the results of which it seems desirable to make known.

More than half (14 out of 25) of the Cercyons recorded in the Leng List are more or less common European species, and in most cases the identity of the North American and European forms can scarcely be questioned. Some exceptions however have been noted. Specimens carefully compared by Mr. Liebeck and found to be identical with the *melanocephalus* and *lugubris* of the Horn collection have been sent me for examination. These, on comparison with the best European descriptions and with authentic European representatives of the species in my collection, prove conclusively that the *melanocephalus* and *lugubris* of the Horn Synopsis[1] are not the true European species of these names.

In the *melanocephalus* of Horn the palpi are said to be entirely pale. In the true *melanocephalus* they are black or dark brown. Ganglbauer, in his Käfer von Mitteleuropa, IV, p. 278, observes this fact and remarks in a foot note that *C. melanocephalus* Horn=*nanus* Melsh and can not be the *melanocephalus* of Linnæus. The intimation here that the species should be known as *nanus* Melsh is of course based on the published American synonymy. In the Crotch List of 1873, and the Henshaw List of 1885, both *melanocephalus* L. and *nanus* Melsh appear.

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[1] Trans. Am. Ent. Soc., XVII, Oct. 1890.

In Horn's paper of 1890 *nanus* is set down without remark as a synonym of *melanocephalus* but on what grounds it is impossible to say. There is not now a single discoverable example of any of Melsheimer's species of Cercyon either in the Melsheimer or Le Conte Collections. It is understood that Le Conte was free to transfer to his own Collection anything he wished from the Melsheimer Collection, and he himself has somewhere stated that he possessed the authentic types of Melsheimer, Haldemann and Ziegler. There are now in the Le Conte Collection specimens bearing name labels (in Le Conte's hand) of three of the Melsheimer species—*maculatus, mundus* and *minusculus*—but nothing bearing the name *nanus* Mels. So far as discoverable there is nothing in the label, type of pin or style of mount, to indicate that any of these specimens came from the Melsheimer collection; if any such there are they must have been remounted by Le Conte.

It follows that in the case of *nanus* at least, there is no recourse but the original description, and this I do not hesitate to say does not agree with the *melanocephalus* of Horn. Melsheimer's diagnosis is rather brief but he describes his insect as "deep glossy black" and remarks that the antennæ are piceous. *Melanocephalus* Horn is on the other hand rather dull in lustre, the elytra, as in the true *melanocephalus* and *pygmæus*, rufous or yellowish with a scutellar triangular black cloud which may spread over the greater part of the disk but never involving the entire lateral and apical margins; furthermore the antennæ are pale.

Fortunately however there is no need to consider *nanus* in this connection, for a careful study of descriptions convinces me that Horn's *melanocephalus* is really another of the European species—*terminatus* Marsh—which has hitherto not been recognised in our fauna. This is of the same type and a close ally of *melanocephalus* and *pygmæus*, differing from the former in the smaller size, entirely pale palpi and antennæ, and the absence of the metasternal line extending obliquely forward to the front angles. The specimens sent by Liebeck as agreeing with Horn's *melanocephalus* all possess precisely these characters, and fit in all other respects Ganglbauer's description of *terminatus*.†

In passing it may be well to say that Horn is in error in saying that *pygmæus* may be distinguished from *melanocephalus* by its pale epipleura. The Epipleura are normally blackish in all three of the species here mentioned, which may be readily separated as follows.

Metasternal area extended by an oblique line toward the anterior angle.

Size much larger—2.2 to 3 mm., palpi blackish. . . . . *melanocephalus*

Size much smaller, always less than 2 mm., palpi yellowish to brownish, the terminal joint darker. . . . *pygmæus*.

Metasternum without oblique line extending forward from the central area; antennæ and palpi pale; length about 2 mm. *terminatus*.

Although I have seen no native specimens, it is by no means unlikely that *melanocephalus* L. may have been found or may yet occur in America.

Cercyon opacellus new species.

This is the species described as *lugubris* Payk. in the Horn Synopsis, but the two seem to me quite certainly distinct, nor am I able to identify our North American form with any other European species. In *lugubris* Payk. the head and prothorax are strongly shining, the surface polished without trace of alutaceous sculpture, the elytra alutaceous and conspicuously dull. In our species the entire upper surface is always finely alutaceous, the head and thorax scarcely more shining than the elytra; the form is also appreciably more convex. Horn's description is entirely characteristic and need not be repeated. Whether the true *lugubris* Payk. (*convexiusculus* Steph.) really occurs with us I am unable to say. I have as yet seen no American examples.

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†Since writing the above I have received from Mr. Arrow of the British Museum a specimen of *terminatus* carefully compared by him with Marsham's type, which completely substantiates my conclusions.

Cercyon minusculus Melsh.

In Horn's synopsis of the genus this species of Melsheimer is for the first time relegated to synonymy and declared to be the same as the European *granarius* Erichs. Careful comparisons by Mr. Liebeck with the series of four specimens (Mass., Pa., D. C.) in the Horn collection upon which his conclusions were based, and by myself with the series of *minusculus*, so labelled, in the Le Conte collection shows them to be identical. These and all examples of the very considerable series in the collections of Mr. Liebeck and myself agree in the strikingly deep and sharply impressed elytral striæ, especially toward the apex. A European specimen of *granarius* in my own collection has the elytra much less deeply striate and the interspaces very finely punctulate, whereas in *minusculus* the punctures of the interspaces are much more distinct and scarcely at all finer than those of the prothorax. *Granarius* and *minusculus* are indeed closely allied, but so far as the evidence at hand goes I consider their identity unlikely, or at least unproven.

Cercyon connivens new species.

A small species of the *lugubris—granarius—minusculus* type. Form rather broadly oval, slightly attenuate behind, very strongly convex, black, the sides of the prothorax very narrowly tinged with rufous, the elytra with a sharply defined apical pale space which extends froward along the outer margins to about the middle. Head and thorax polished, densely moderately finely punctate, elytra finely alutaceous and duller, a little more shining however along the suture, the striæ impressed and entire, a little deeper at sides and apex; interspaces sparsely punctulate, the punctures finer than those of the prothorax but quite distinct. Beneath piceous or rufopiceous, legs and antennæ reddish brown, palpi a little paler; meso—and metasternal plates very densely and unusually coarsely punctate.

Length 1.6 to 2 mm.; width 1. to 1.3 mm.

Of this species I have seen a considerable series from Camden, Gloucester and Anglesea, New Jersey, mostly collected by

Mr. Liebeck and a single specimen from Wakefield, Mass. taken by myself. One of the Camden specimens is selected as the type; it bears date "xi-23."

From *minusculus* the present species differs in being less broadly obtusely rounded behind; from both *minusculus* and *granarius* by the sharply limited apical pale area and the distinctly alutaceous surface sculpture of the elytra; from *opacellus* by the non-alutaceous head and thorax, and distinctly punctate elytral interspaces, and from all allied forms by the more coarsely densely punctured sternal areas.

C. connivens is really by its polished head and thorax and alutaceous elytra more nearly allied to *lugubris* than to any of the above mentioned species, and perhaps most closely of all to *subsulcatus* Ray of the European fauna. The latter however is said to have the elytral interspaces not or scarcely detectably punctate, which statement is not properly applicable to our species.

Cercyon californicus new species.

Oval, a little attenuate posteriorly, form nearly as in *tristis* but slightly less convex. Black, prothorax with either the entire side margin or (typically) with only a spot at the front angles paler; Elytra with a distinctly limited pale area which extends forward along the side margins at least to the middle, and often quite to the base. Head and thorax distinctly alutaceous, finely numerously punctate; elytra visibly but as a rule somewhat less distinctly alutaceous than the thorax, striæ fine and very lightly impressed, becoming obsolete just before the apex; interspaces sparsely punctulate, the punctures generally a little finer than those of the prothorax; eighth interspace uniserially punctured. Body beneath piceous, the epipleura paler in those examples in which the pale color of the apex extends forward to the humeri; legs reddish brown to piceous brown; palpi brown with the last joint darker; antennæ rufotestaceous, the club piceous. Mesosternal area evenly oval, twice as long as wide, rather coarsely punctured; metasternal area more finely sparsely punctate.

Length 1.8 to 2.4 mm.; width 1 to 1.3 mm.

California—Elsinore Lake 8-22-17 (type); Pomona; San Diego; San Francisco. All collected by the writer. Although slightly less convex than most species of Horn's category "13" this species by all essential characters belong there and should stand next to *tristis*, from which and all others of the group it differs by having the prothorax more noticeably alutaceous than the elytra. In one example from Pomona the alutaceous sculpture is equally developed over the entire surface.

The species belonging to Horn's category "13" (except the very distinct *navicularis*) may with advantage be retabulated as follows:

Entire upper surface alucateous.
  Alutaceous sculpture equally developed on thorax and elytra; form shorter and more convex (Eastern U. S.). *opacellus*.
  Alutaceous sculpture as a rule a little more distinct on the thorax; size a little larger, form evidently less convex (California). .... *californicus*.
Head and thorax polished, elytra distinctly alutaceous.
  Elytral striæ extremely fine, scarcely impressed, obsolete toward the apex. .... *tristis*.
  Elytral striæ entire.
    Elytral interspaces very finely to scarcely visibly punctulate.
      Striæ fine.................................. *lugubris*.
      Striæ much stronger. .... *subsulcatus*.
    Elytral interspaces distinctly punctate, striæ well impressed.. .... *connivens*.
Entire surface shining and with at most but feeble traces of alutaceous sculpture on the elytra.
    Elytral apex with sharply defined pale area. . . . *floridanus*.
    Elytral apex at most only diffusely and obscurely paler, often scarcely at all so.
      Elytral striæ fine, the interspaces much more finely punctate than the prothorax. . . . . *granarius*.
      Elytral striæ sharply and deeply impressed, the punctures of the interspaces nearly as coarse as those of the thorax .... *minusculus*.

Cercyon maculatus Melsh.

Analis Horn nec Paykull., *indistinctus* Horn.

The *C. maculatus* of Melsheimer is given in Horn's synopsis as a synonym of *analis* Payk. The species which Horn thus describes is undoubtedly Melsheimer's *maculatus* as accepted by Le Conte but is an entirely different thing from Paykull's *analis*. The latter is a narrower, blacker, more attenuate species, resembling more in general aspect the species of the *lugubris* group than it does *maculatus* and allies. According to the books *analis* constitutes the subgenus Paracercyon Seidl., differing from all other European species in having the metasternum angularly emarginate between the middle coxæ for the reception of the point of the mesosternal plate. Mr. Liebeck writes me that there are three examples of the true *analis* (Phila. Neck) in the Horn series of *analis* but he is of the opinion that these have been added since the Horn Revision.

The characters upon which *indistinctus* Horn was founded, viz.—the color of the elytral apex and the punctuation of the eighth interspace, are variable and lie within the limits of variation of *maculatus*. Specimens identical with the type series of *indistinctus* have been sent me by Mr. Liebeck and I do not hesitate to confirm his opinion to this effect.

HOW A BEETLE FOLDS ITS WINGS

Wm. T. M. Forbes.

Cornell University, Ithaca, N. Y.

When I was a boy in high school I became interested in insects, and started a collection. Having no adviser to misguide me I carefully pinned all my beetles through the scutellum and spread them like butterflies, which made a curious-looking collection, but developed in me an interest in the wings of beetles that has not yet faded. The title of this paper is one of the first questions that I asked, and one of the many to which I found no answer. The present answer is merely a hint, but I think, correct so far as it goes.

The first suggestion one would make, and I think the one that has been hinted at in the literature, is that the beetle wing is in its resting position straight and stiff, like that of any other insect, and that the beetle folds it and packs it away with the help, perhaps of its hind legs, perhaps of the tip of its abdomen. I think this answer is partly correct, most nearly so in such Clavicorns as the Nitidulidæ and Coccinellidæ, where when the wing is released it snaps open ready for flight. But in the more familiar of the larger beetles, such as the Adephaga and Serricornia, it will be found that the natural condition of the wing is folded, completely or almost completely, and the question arises how the wing is opened, and what holds it stiff for flight. The present paper aims at answering this question.

Serricornia.

Let us take a beetle of somewhat simple type of folding,—the Lampyrid, *Telephorus* (figs. 1-3). Remove the elytron and pull forward on the costa of the wing. We will find the wing swings out from the body as a folded bundle until it is almost in the flying position, while the anal area unfolds. Finally the anal area is completely unfolded and a strain comes on the disc of the wing. Then suddenly the fanlike fold in the middle of the wing opens, and at the same moment the apex unfolds and flattens out. Now let us see the possible mechanism.

Represent the principal lines of stiffness in the wing by heavy solid bars, as in figure 3: A, B, C, D, E. As A is drawn away from E the part of the wing lying between them will first unfold like a fan, and soon become tense. I have represented the lines along which the tension is most important by chain-lines on the diagram: A1-B1, A2-B2, B2-C, C-D, D-E. The flattening of the basal part of the wing is obvious enough; but the reason why the apex opens is not so plain. Now let us represent the principal lines of stiffness in each folded area of the apex of the wing in the same way as the basal ones. There are four of these areas, but one is so supported by the surrounding ones that it will be seen to need no support, and a glance at the chitinizations in the wing-substance shows that in fact it has none. The other three may be represented by the bars K, N and S. Take K. The inner half of it lies between the bars A and B, in such a way that it lies in taut, flat membrane. So any tendency to bend it up or down will draw on the lines of tension A1-B1 and A2-B2, which will elastically support it. A working model can be easily made by looping two rubber bands on two fingers, and then running a match through the two bands (fig. 8). N is supported in exactly the same way. Then the tips of K and N in turn develop a third line of tension (K-N), which, with the help of A2-B2 supports S in a similar manner. It can be seen that the small folds in the middle of the wing are supported by the tension between A and B, and so have no structural value. In fact the arrangement of these folds varies a good deal in detail among forms that have essentially this manner of folding, being considerably more complex in the Elateridæ, and especially the Hydrophilidæ, and somewhat simplified in such forms as Cebrio and many Buprestidæ. These variations are of considerable value in throwing light on relationships, but do not affect the mechanics. In the same way the fourth of the outer areas, below S, (which we may call T) is supported by the tension between S and the apex of N, and needs no structural support of its own. In sum the support of the unfolded wing is due first to the fanlike arrangement of the supports which run from the base, and the tension which muscles in the base put on the first and last of them (A and the body behind E), and secondly that in the outer part each succeeding series of supports overlaps the apex of the preceding, and is held flat by the tension between members of the preceding series. So all folds in the outer part of the wing should necessarily be chevronlike, zigzagging between the apices of an inner, and the bases of an outer series of supports. We find this arrangèment very general, not only in the other Serricorns, but even in such aberrànt things as the Staphylinidæ; but in the Adephaga a further specialization comes into play.

Adephaga.

I have chosen *Cicindela sexguttata* (figs. 3-7) as a fair example of the Adephaga. In general it is typical of the terrestrial Adephagous series, but differs from most Carabidæ in having a strong apical portion of vein R4+5, supporting the outer part of the wing along the line lettered M in the diagram. So the details of conditions in the apex will not be duplicated outside of the Cicindelidæ, through the central part of the wing is as in the true Carabids.

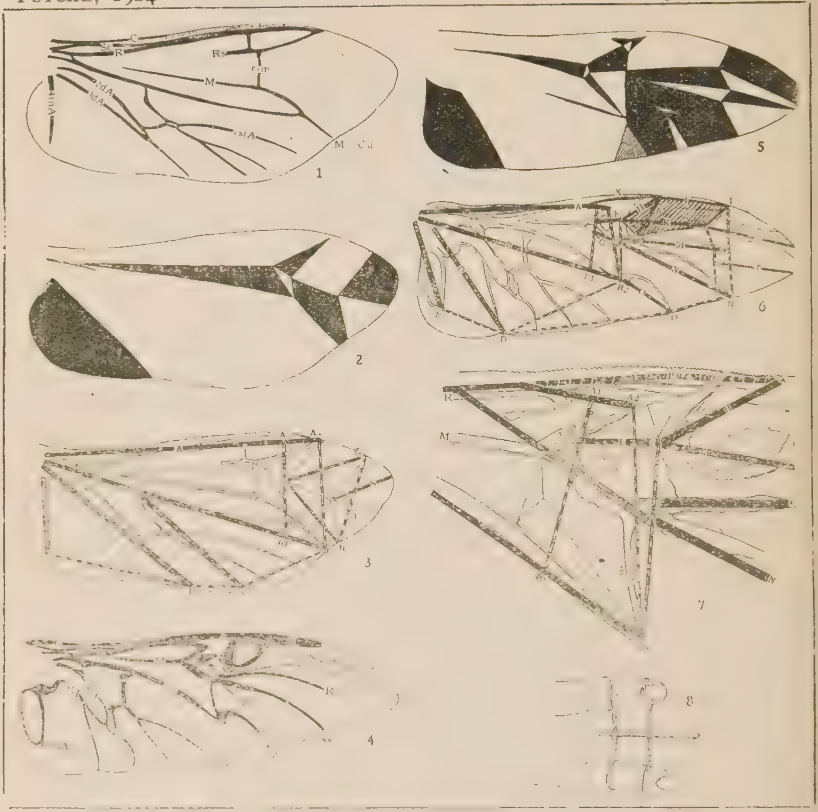
Conditions in the base of the wing are exactly as in the Lampyrid, so far as the mechanics is concerned. (The fan-like fold in the vicinity of M has a different relation to the veins and is probably homologous not to the one so conspicuous in the Lampyrids, but to another below it which appears in many other Polyphaga.) When we come to the principal fold we find that there is no definite chevron-like arrangement that could explain the stiffness of that part, as in the Lampyrid, but that the folds across all the principal veins lie in a straight line. On examining the wing it is found that the stiffness of the outer part of the wing in flying position is wholly due to the curiously constructed costal margin (formed of the fused veins C, Sc and R1) This is rather a flat ribbon than a normal vein, and is also ribbed transversely on its front edge, so that it bends easily from front to back, but is very stiff against any vertical pressure.

Looking at the diagrams (figs. 6 and 7) A, B, D,. and E are as in Telephorus. C is also represented by veins, but is not needed to explain the unfolding of the wing. Next comes F. This bar in the diagram represents an insignificant-looking, but in fact very important sclerite which the tracheation shows to be a fragment of vein Rs. It is thrown into a horizontal position and supported by the tension between A and B, exactly as in the Lampyrid. The fragment of vein M represented by bar G is also apparently of some use, though as it is crossed by one of the folds it must be flexible, and is resistent only to compression. It no doubt helps to fix the bases of M and N. The outer part of the wing is held flat in a curious way. E as already stated can be bent back, but not up or down, on account of its peculiar structure; and it is attached at its outer end to a large area supported by a complex of strong veins (HILKJ). This area is only kept from bending up or down by the support of E, and is kept forward by the support of the tip of F, which articulates with it and pushes against it, as can be demonstrated by cutting E and F in turn. The tip of J may also get some support from the tip of G, which will help keep the whole area from bending down obliquely by twisting X. Altogether the whole area seems very weakly supported, but I can find no other factor. HILKJ, in turn, supports the entire posterior part of the wing by tension in the direction indicated by chain-lines on the diagram. This pull has to act against a strong spring-like action of the root of O, which tends to fold up the wing, and it seems surprising that the bracing of H by F is strong enough to do it. The apex of the wing is supported by S in relation to I and M, and by T in relation to M and S, in much the same way as S is supported by K and N in the Lampyrid.

Other Adephaga show a great deal of variation, especially in the outer part of the wing; but I believe the relation between X, F and H, to stiffen the outer part of the wing, is functional in all.

It will be interesting to compare other beetles with these two principal types of folding, and especially to find if any other mechanism is made use of. As I said at the start, I have a strong suspicion that in the various Clavicorn groups there are still other methods of folding, and some seem to make use of the feet. But careful observation of living specimens will be necessary to settle the matter. I hope this paper will attract some good observers to a very interesting problem.

PSYCHE, 1924 VOL. 31, PLATE 9



FORBES—WING FOLDING IN BEETLES

EXPLANATION OF PLATE 9.

1. *Telephorus* species (Lampyridæ). Venation.

2. Same. Folding pattern. (Areas reversed in folding black).

3. Same. Mechanics of folding. (Lines of stiffness are represented by heavy solid lines, lines of tension by chain-lines).

4. *Cicindela sexguttata* (Cicindelidæ). Venation.

5. Same. Folding pattern.

6. Same. Mechanics of folding.

7. Central costal part of fig. 6, more enlarged.

8. Method of stiffening apical part of wing, illustrated by a model.

ON THE SYSTEMATIC POSITION OF THE FAMILY TERMITAPHIDIDÆ (HEMIPTERA, HETEROPTERA), WITH A DESCRIPTION OF A NEW GENUS AND SPECIES FROM PANAMA.

By J. G. Myers[1].

Relationships of the family, Termitaphididae (nom. nov.)

In 1902 Wasmann erected the genus, *Termitaphis*, on a peculiar termitophile which he called *Termitaphis circumvallata*, and which he considered an aberrant aphid. Silvestri, describing two additional species in 1911, recognized that the genus was not even homopterous and established for it the new family Termitocoridæ, which he placed in the sub-order, Heteroptera. In 1914 a further species was described in a preliminary manner by Mjöberg, while in 1921 Silvestri recorded from India a fifth species of the genus. These references were all listed in the Zoological Record under the family, Aphididæ, and apparently received no attention from heteropterists. The list of species was brought up to eight by Morrison in 1923. Such in brief is the history of the genus.

The writer is indebted to Dr. W. M. Wheeler for the opportunity to study and describe a ninth species collected at Panama and to offer some suggestions on the relationships of the family to other heteroptera. Mr. Harold Morrison had also received specimens of the same insect from Panama, and was about to describe it but has very generously turned over his material to me.

The Rev. E. Wasmann most kindly sent for comparison the unique specimen of the type of the genus. Thanks are due also to Dr. W. M. Mann for bringing this valuable type from Europe. Previous workers have invariably referred their material to the type-genus, but Wasmann's type shows that it is decidedly not congeneric. A new genus, *Termitaradus*, is therefore erected here for the Panama species and its allies, which undoubtedly include all species described subsequently to *T. circumvallata.*

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[1] Contributions from the Entomological Laboratory of the Bussey Institution, Harvard University, no. 243.

None of the previous workers on these insects has made any suggestion as to the position of the family in the Heteroptera. Nor have the heteropterists themselves given the matter any attention although the very detailed and entirely adequate descriptions and figures of Silvestri and of Morrison were all that could be desired in the absence of actual specimens.

Silvestri's family name must be changed in accordance with the International Rules, which state that the family name must be derived from that of the type-genus. *Termitaphis* Wasm. was the original genus, and was used by Silvestri as the type-genus. The genus, *Termitocoris* apparently does not exist. The family name must therefore be Termitaphididæ. Dr. Wheeler drew my attention to this point.

Superficially the insects of this family are remarkably distinct from all other Heteroptera. This unique appearance is in keeping with a habitat shared, so far as known, by no other members of the sub-order. All the species collected have been found in the nests of termites, and such characters as are entirely peculiar to the family may be tentatively explained as results of adaptation to the termitophilous habit.

Reuter's (1912) Bemerkungen über mein neues Heteropterensystem was taken as the latest authoritative and comprehensive review of heteropterous taxonomy.

In following the key to families and also in comparing the separate diagnoses of Reuter's series and superfamilies, it was found that the *Termitaphididæ* were best placed in or near the series *Phlœobiotica*, a group established to contain the two families of bark-bugs, the Aradidæ and the Dysodiidæ, of which the latter is now by most authorities, e. g. Parshley, 1921, considered a sub-family of the former.

Reuter's diagnosis of this series is as follows (1912, p. 32).—

Unguiculi semper aroliis destituti. *Caput horizontale, inter antennas longe prolongatum,* utrinque tuberculo antennifero plerumque acuto instructum, bucculis sulcum rostralem formantibus. *Ocelli desunt. Rostrum quadri-articulatum,* sed articulo primo minutissimo, aegre distinguendo. *Antennæ capite*

plerumque longiores, quadriarticulatæ, sæpe crassæ. Hemielytra e clavo, corio et membrana composita. Clavus apicem versus sensim angustatus, apicem scutelli nunquam superans. Membrana venis nonnullis irregularibus et anastomosantibus vel raro his tota destituta. *Meso-et metapleura simplicia. Coxæ posticæ rotatoriæ. Tarsi biarticulati.* Corpus superne et inferne deplanatum.

The characters italicized are those which are clearly exhibited also by the *Termitaphididæ*. The widest divergence lies in the wing characters, both pairs of wings being completely absent in the latter genus. But presence or absence of wings was never even a family character and there are Aradids with both pairs missing. There is therefore a strong presumption that the Termitaphididæ are related to the Aradidæ. The presumption is rendered almost a certainty by three other considerations now to be examined in some detail.

Reuter (1912) laid considerable emphasis on the presence or absence of arolia as a taxonomic character. The Aradidæ are said to possess no arolia and it was largely on this account that Reuter was unable to agree with Kirkaldy and with Bergroth that the Aradidæ exhibit marked affinity with the Pentatomoids. The Termitaphididæ on the other hand are furnished with very well-developed arolia shown clearly in Silvestri's excellent figures (1911, 1921). Whether this deficiency should be taken to indicate lack of affinity between the *Termitaphids* and the Aradids is questionable, since it is doubtful whether these organs afford such good taxonomic characters as has been supposed. In fact Reuter, who used their presence or absence so largely, has himself shown (1912) that they are probably of directly adaptive origin, varying apparently with the habitat even in genera of the same family. In the present case however no decision as to the importance of the arolia is essential to the argument since the Aradid genus, *Ctenoneurus* Bergroth, (Dysodiinæ, Mezirinæ) possesses arolia as well-developed as those of *Termitaphis*, or as those of any of Reuter's aroliate families —Miridæ, Pentatomidæ etc. The arolia of *Ctenoneurus hochstetteri* (Mayr) are shown in figure 9. This constitutes the first supplementary proof of the relationship of *Termitaphis* to the Aradidæ. Similar structures

occur in certain species of the genera *Aradus*, *Dysodius* and *Isodermus*.

Incidentally the term "arolium" is used in general insect morphology and in hemipteran taxonomy with several different meanings which urgently need elucidation. Crampton (1923) applies the name primarily to the undivided pad-like structure between the claws of Orthoptera, e. g. *Periplaneta*. Further he mentions that the arolium in certain Hymenoptera and Homoptera may be partially divided or faintly marked off into two lateral portions. There is no reference in Crampton's paper to the fact that in Heteroptera the arolium is always divided and in fact is referred to by taxonomists only in the plural. As illustrative of the most exact use of the term in Hemipterology, figure 11 shows the arolia of a Mirid after Knight (1923). The same drawing shows also the *pseudarolia* which in many Mirids are greatly developed and perhaps take the place of the true arolia which are reduced to mere bristles. Knight's arolia arise as shown in the figure truly between the claws and are probably homologous with the undivided arolium described by Crampton. But in Pentatomids, Coreids, some Aradids and in *Termitaphididæ*, the present writer finds that the arolia do not arise between the claws, but each from the base of the corresponding claw as shown in figures 7, 9 and 12. In these families it would seem that the so-called arolia are really homologous with the pseudarolia of the Miridæ, while the true Mirid arolia are represented by bristles between the claws as shown in the Pentatomid, *Euschistus* (fig. 12) and in a *Termitaphid* in Silvestri's drawings. Organs evidently exactly homologous with the so-called arolia of *Euschistus*, *Ctenoneurus* and *Termitaphis* are described and figured in the Coreid, *Anasa*, by Tower (1913) as *pulvilli*.

Whether the appendages figured in *Termitataradus* and in *Ctenoneurus* constitute true or pseudarolia or pulvilli does not affect the question of relationship since they are obviously homologous structures in the two genera.

In 1920 Spooner for the first time recorded a peculiar condition in the Aradid head in which the rostral setæ, instead of proceeding more or less directly cephalad and then caudad to enter the labial trough or rostrum, are coiled several times, like a watch-spring, in a semi-circular sheath formed by the tylus. The setæ are thus extremely long. That such an extraordinary condition should previously have escaped the notice of hemipterists is probably the result of the heavy chitinisation and black coloration of the head, which renders this structure entirely invisible in the untreated insect. The present writer noticed the setal coil independently in 1920 in the newly hatched nymph of *Ctenoneurus*, in which the coil shows as a dark mass against the soft white nymphal tissues. This arrangement of the trophi is present in an almost identical condition in the *Termitaphididæ* and constitutes the second supplementary proof of the relationship of these interesting termitophiles with the Aradids. To these two families alone of the Heteroptera are the coiled setæ apparently confined.

Here we meet the difficulty that the feeding-habits of Aradidæ and even more so of the Termitaphididæ are very little known. It seems likely that the insects of both families suck the sap of trees or the moisture of dead wood and of fungi. Obviously only liquid nutriment could be taken up by such mouthparts.

The first important character in which the *Termitaphididæ* appear to differ from the Aradidæ lies in the extraordinary development of laminæ on the margin of the body, round every portion of the periphery. These laminæ are furnished with stout outwardly directed bristles and with peculiar *flabella*, so named by Morrison. In some Aradids there is a lobulate expansion of the flattened lateral margin of the body. Such lobes are conspicuous in the imago of *Dysodius lunatus* (Fabr.) of which Dr. Nathan Banks has shown me specimens from Panama. In addition, Dr. Wheeler collected at Barro Colorado Island, Canal Zone, Panama, a single *Dysodius* nymph, probably referable to *D. lunatus*. This nymph, which is apparently in the third stadium, shows the marginal lobes very well-developed and offering striking points of resemblance to those of *Termitaphis*. There are twelve rounded lobes on each side of the body, not including projections of the head. The first is pro-, the second meso- and the third and fourth together metathoracic, while the rest pertain to the abdomen. Every lobe (fig. 10) is furnished with an irregular series of long conical processes, evidently hollow and provided with a rather thick but elongate distal flagellum usually more or less curved. The flagella are very liable to be broken off, particularly from processes near the apices of the lobes; and many are missing in the nymph under study. In the pinned imago of *Dysodius lunatus* no trace of the flagella is discernible, but in alcohol specimens examined later they are as well-marked as in the nymph. In the nymph there is thus a striking similarity to *Termitaphis* in the essential features of the marginal lobes. The number and distribution of the lobes themselves, their division into lobules or processes, the presence on every lobule of an easily detachable solid appendage arising apparently at the base of the lobule and running through or beneath its axis to protrude beyond its apex—in all these particulars there is practical agreement between the two genera. These constitute a third group of facts which may reasonably be considered to support the hypothesis of relationship between the *Termitaphididae* and the Aradidæ. The most striking superficial difference lies in the fact that the lobes in *Dysodius* are widely separated and thus fail to form such a continuous peripheral margin as in the *Termitaphididæ.* In the *Dysodius* nymph the conical processes with flagella are present also on the margin and projections of the head, and on the segments of the antennæ. The metanotum is provided with two lateral lobes instead of one as in *Termitaphis* and allies.

It seems probable that marginal laminæ in *Termitaradus* constitute a defensive apparatus enabling the insect to withdraw all its appendages under cover. For such withdrawal the form and articulation of the peculiar antennæ are especially adapted. Were the laminæ closely appressed to the substratum there would remain no unprotected part of the whole periphery. A similar development of lateral laminæ is frequent in myrmecophiles and termitophiles, notably in the larva of *Microdon* and in certain beetles and Myriapoda. In the termitophilous millipedes of the genera *Leuritus* Chamberlin and *Gasatomus* Chamberlin the general form of the body segments with their lateral lobes is strikingly reminiscent of the condition in *Termitaradus*

Wasmann (e. g. 1911, pp. 228-230) recognises this type of lateral lamination of body segments coupled with flattening of the ventral surface, as a direct adaptation to termitophily or myrmecophily—as a protection against the owners of the nests in which these arthropods live. It is a modified form of the adaptive type which he designates "der Trutztypus." All the specimens of *Termitaphididae* so far known have been collected in company with termites or in their nests.

The total absence of eyes and ocelli in *Termitaphids* is probably correlated with life in the gloomy recesses of the termite nest. The Aradids, themselves living in a cryptozoic habitat, have advanced a stage in this direction in that ocelli are lacking. The absence of wings in *Termitaphids* is similarly explicable. The peculiar structure of the antennæ, by which a superficially cryptocerate condition has been achieved, has been explained as a provision for tucking these organs under the cephalic laminæ. The antennæ are inserted very near the lateral margin and are folded in towards the rostrum.

The chief remaining morphological distinction between the *Termitaphids* and the Aradids lies in the structure of the rostrum and related parts. The head itself differs considerably. In the former it is more flattened and exhibits on side margins and fore-border a remarkable lamination with division into two main lobes on each side. This condition could perhaps be derived from that of a typical Aradid by an antero-lateral extension and lamination on each side of the tylus, so that the latter instead of forming the anterior projection of the head as in most Aradids, came to lie at the posterior end of a deep incision extending caudad from the anterior margin of the head.

So far as the rostrum is concerned the Aradids show a condition which has been described as apparantly three-segmented but really four-segmented. As a matter of fact, in *Ctenoneurus* at least, (fig. 8) the second segment is peculiarly constricted where it lies between the bucculæ, but four distinct segments are easily discernible. In *Termitaphids* the bucculæ form no appreciable sulcus for the rostrum. Wasmann described and figured the rostrum of *Termitaphis* as three-segmented and such it decidedly appears to be to all but the most searching examination. Silvestri, however, in all his work characterizes it as four-segmented and shows four very distinct segments in his figures. Such distinctness is certainly in error. The second segment, reckoning on this basis, is very indistinctly articulated and the present writer is by no means sure that it constitutes a true segment. (Figs. 2, 3).

The dorsal pores described and figured by Morrison are unlike anything known in other Heteroptera. Possibly, however, this worker's technique would reveal similar structures in other families.

To sum up it would appear that the Termitaphididae may be regarded as Aradoids specialized, in some respects degeneratively (absence of wings, eyes, ocelli and rostral sulcus), in others additionally (lateral lamination and armature and folded antennæ in *Termitoradus;* physogastry in *Termitaphis*), for a life of termitophily.

The diagnosis of the series Phlœobiotica (superfamily Aradoidea) as set out by Reuter in 1912 and quoted above, may be modified as follows to include the Termitaphididæ.—

Arolia present or absent; head horizontal, much prolonged between the antennæ or else furnished with an acute antenniferous tubercle; a rostral sulcus formed by the bucculæ present or absent; ocelli absent; rostrum 4-segmented, often thickened. Hemielytra when present formed of clavus, corium and membrane; clavus narrowed towards the apex and never reaching beyond apex of scutellum. Membrane with some irregular and anastomosing veins or rarely completely destitute of venation. Meso-and meta-pleura always simple. Posterior coxæ rotatory. Tarsi 2-segmented. Body except in *Termitaphis* flattened above and below.

This series and superfamily comprises two families distinguished as follows.—

Tylus forming anterior projection of head; bucculæ forming a rostral sulcus; margin of body more or less simple or furnished with well separated irregular lobes. . . . . *Aradidæ* (Spin.)

Tylus at end of a deep incision extending caudally from anterior margin of head; bucculæ forming no appreciable rostral sulcus; margin of body furnished with lobes, separate or fused, which form a practically continuous lamina encircling the whole.

Termitaphididæ (n. n.)

As regards the position of the series Phlœobiotica, the discovery of arolia or similar structures in the Aradid, *Ctenoneurus*, is a further indication that Bergroth is correct in considering it nearest related to the Pentatomoids. Reuter was impressed by the fact that the eggs of Pentatomoids and of Coreoids are operculate, the embryo being furnished with a peculiar egg-burster for forcing up this lid; while the ova of Aradids, according to Heidemann, lack lids entirely and resemble more those of Lygæids. The operculum and correlated egg-burster are, however, by no means universal in the Pentatomoids, since they are totally lacking in the New Zealand Acanthosomatine genera, *Oncacontias* Breddin and *Rhopalimorpha* Mayr. The writer's notes on these insects are now in the press. In addition, observations now being carried out on certain North American Coreoids indicate a lack of these structures in this superfamily also. Since the above was written I have seen Barber's (Psyche, 1923) description of the egg of *aradus 4-lineatus*, which has a distinct cap and chorial processes.

BIOLOGY OF TERMITAPHIDIDAE.

Very little is known under this heading. All the recorded specimens have been collected in association with termites, of which the following species have been identified. The hosts of Dr. Wheeler's Panama examples were kindly determined by Mr. Banks, those of the other Panama material by Dr. Snyder.—

Termitaphis circumvallata Wasm.,	*Amitermes foreli* Wasm.,	Colombia.
Termitaradus mexicana (Silvestri),	*Leucotermes tenuis* (Hag.),	Mexico.
T. subafra Silv.,	*Rhinotermes putorius* Sjöst.	Africa.
T. australiensis (Mjöb.),	*Coptotermes* sp.,	Australia.
T. annandalei (Silv.),	*Coptotermes heimi* Wasm.,	India.
T. guianæ (Morr.),	*Leucotermes crinitus* (Emerson),	British Guiana.
T. trinidadensis (Morr.),	*L. tenuis* (Hag.),	Trinidad.

T. insularis (Morr.),	*L. tenuis* (Hag.),	Trinidad.
T. panamensis n. sp.,	*L. tenuis* (Hag.), *L. convexinotatus* Snyder	Panama.

In view of the additional species which have been brought to light within recent years coincident probably with intensified study of termites and of termitophiles, it would be premature to say much about distribution of the family. At present Central America seems to be the centre of greatest abundance but this may be due to greater collecting in the region. The distribution is certainly however practically circumtropical. In many respects it resembles that of *Peripatus* (sens. lat.) and may, as in the case of that genus indicate considerable antiquity as Mjöberg has suggested.

Habitat notes of the previously described species are scanty in the extreme. Of *T. mexicana*, Silvestri (1911) writes "in cuniculis nidi *Leucotermes tenuis* (Hag.)." When describing *T. annandalei* the same writer states "in nido *Coptotermes Heimi* Wasm., in trunco arboris (*Ficus bengalensis*) emortui et super solui sistentis exempla nonnulla Dr. N. Annandale legit." Mjöberg found a number of examples of his Queensland species "under bark of dead eucalyptus trunks in the colonies of a white ant (*Coptotermes* sp.) in the open forest country."

Dr. Wheeler found the Panama specimens within a termite nest (*Leucotermes convexinotatus* Snyder) the Termitaphids themselves being close to the cambium of the tree trunk from which they might probably have extracted nourishment. They were running about fairly actively.

What little is known of its habitat therefore seems to suggest that *Termitaphids* may have the same feeding habits as the Aradidæ.

What advantage they derive from living in the termite nest is uncertain. *Termitaradus* is probably protected from the termites themselves by its lateral laminæ and their armature. *Termitaphis* exhibits a certain degree of physogastry, a well-known feature of termitophiles and one which might indicate this genus as the more specialized of the two, though in the structure of the body margin it is intermediate between the Aradids and *Termitaradus*.

Dr. Wheeler suggests they may extract nourishment from either the nest material or the contained debris. Wasmann (1902) considers *Termitaphis* and *Termitococcus* Silvestri as affording the only known cases of trophobiosis among termites. Of *Termitococcus* nothing has been reported since the original description. As regards *Termitaradus* the peculiar dorsal pores discovered by Morrison may possibly secrete some material attractive to the termites, but only field observations can decide this point.

Most of the species of the family have been described from females alone. Males are now known of *Termitaradus annandalei*, *T. guianæ* (?), and *T. panamensis* sp. n. Silvestri has given good figures of the male genitalia. Nymphs have been found of *T. annandalei* and of *T. panamensis* only. Silvestri has figured the outline of the body of the ultimate and second (?) instars in *T. annandalei*. Both these instars have one lateral lobe on each side of the body more than in the imago (female) the numbers being 14 and 13 respectively. The same difference is observable in *T. panamensis*, between all female nymphs examined and the common 13-lobe type of female adult. Silvestri considers the additional lobe in the nymph to belong to the metathorax but to the present writer it seems to correspond exactly to the extra lobe present in the adult females of some of the species and shown by Morrison to pertain to the mesothorax. The reduction of lobes has gone furthest in *T. insularis* (Morr.) in which the female possesses only twelve, the number present in the males of those species in which both sexes are known.

TAXONOMY.

An examination of the unique and beautifully preserved type of *Termitaphis circumvallata* Wasm. shows it to be a female, of a different genus from all later described species. Wasmann's figures (1902) express these divergences quite clearly. It is a very different-looking insect with a swollen egg-shaped body surrounded by an incurved and upcurved dorso-lateral, segmentally-divided lamina almost meeting on the anterior half of of the body and showing the structure described in the key below. Some of the Panama material showed an upward curling of the laminae in alcohol, but the condition thus artificially produced was not even superficially similar to that in *Termitaphis*. The Panama species is strongly flattened above and below, both in alcohol specimens and in life (Professor Wheeler), whereas Termitaphis would be rotund even were the laminæ removed entirely. A new genus is therefore erected for the Panama species and for all other species described since *T. circumvallata*. The Panama material was used as the genotype as it is the best known to me.

Silvestri's family diagnosis (1911, p. 232) may be modified by deletion of the phrase "corpus valde depressum," and by changing his statement regarding stigmata to read as follows: stigmata 9, of which two are thoracic. and seven abdominal.

The two genera may be separated as follows: *Termitaphis*, Wasm. (1902, p. 105); Body egg-shaped, surrounded by a strongly incurved and upcurved, dorso-lateral segmentally divided lamina, the edges of which are further divided into distinct, often quite distantly separated lobules each with a long fine almost smooth flagellum.

Type, *T. circumvallata* Wasm.

Termitaradus, gen nov., Entire body strongly flattened above and below and surrounded by a flat lateral segmentally divided lamina the margin of which is crenulate forming short non-separated lobules, each provided with a short, circular, clavate or lanceolate flabellum with serrate edges.

Type, *T. panamensis*, sp. nov.

In addition, the tylus, covering the setal coil, is in *Termitaphis* strongly protuberant, while in the other genus it shares the general flattening of the body. In the structure of the rostrum, antennae, legs and last ventral segments of the female the two genera are similar.

To Wasmann's original description of *T. circumvallata* may be added the following: marginal lamina on each side divided into 13 lobes (Wasmann did not count the minute 8th abdominal), bearing lobules as follows: 6, 3 (head), 9 (prothorax), 7 (mesothorax), 7-8 (metathorax), 8-10, 8-9, 9-10, 8-9, 7, 6, 5, 3 (the 8 abdominal segments). There are thus fewer head lobules than in any other species of the family and more than the average of abdominal lobules. The flagella seem to me in most cases longer than figured by Wasmann. Both in the distinct separation of the marginal lobules and in the length and flagellate appearance of their appendages *Termitaphis* is clearly intermediate between the Aradid nymph described above and *Termitaradus*. The swollen form of the body is however very un-Aradoid, and may be best explained as an instance of termitophilic physogastry.

THE SPECIES OF TERMITARADUS.

Eight species, including the new one described below may be referred to this genus. Of these, one, namely *T. australiensis* (Mjöb.) is quite inadequately described and its relationships at present obscure.

The important characters in the genus appear to be the form and average number of the flabella. It is therefore unfortunate that these peculiar structures are so easily detached. In their absence however, their number can be ascertained by counting the lobules in which they arise. The *number* of the lobes, at least in those species which show 13 or 14 on each side seems less reliable. One would of course have been inclined to regard the presence or absence of an additional lobe as a character at least of specific importance, but the following considerations have led the writer to reject it as such.—

It is a single meristic character, and such are known to vary intraspecifically.

Nymphs in species in which the adult female is 13-lobed (*T. annandalei* and the normal 13-lobed Panama form) show the extra lobe clearly developed.

Specimens taken together in the case of three separate lots include a mixture of 13-lobe and 14-lobe examples.

The specimens in these lots agree exactly in all other characters.

The males taken with these lots are all identical and all show 12 lobes, as does also the male of the typically 13-lobed *T. annandalei.*

The 14-lobed specimens have the lobes distributed as follows in the manner indicated by Morrison.—2 to the head, one to the prothorax, 2 to the mesothorax, one to the metathorax and eight to the abdomen. Silvestri differs from this interpretation in considering the extra lobe (which by the way may be easily distinguished by its smaller size) to belong to the metathorax in *annandalei* nymphs, and to the prothorax in the 14-lobed adults, while Morrison assigns it to the mesothorax. The writer agreed with Silvestri but a rigorous combined examination by Mr. Morrison and himself of material treated in different ways has led to the conviction that Morrison's interpretation is correct.

The males differ from the females in that none of the abdominal segments after the seventh are furnished with lobes or form part of the marginal lamina. In number of flabella on head, thorax and segments 1 to 7 of the abdomen they agree with the corresponding female except that there is a tendency towards an average of one more flabellum in the abdominal segments.

The following table shows the number of lobules and their flabella on one half of the body in the seven adequately known species, in the females only. The thirteen-lobed form of the Panama species has been taken as typical and the description founded on it alone. Should future work show that the fourteen-lobed form is specifically distinct there need then be no confusion.—

	mexicana	*subrafra*	*annandalei*	*guianæ*	*trinidadensis*	*insularis*	*panamensis*
Head	7 4	7 3	8 3	7 3	7 3	7 3	7–8 3
Prothorax	9	12	10	9–10	8	10–11	10
Mesothorax	4 5	4 5	6–7	4 4	4 4	11	5
Metathorax	5	5	6–7	4–5	3–4		5
1st abdominal	7	7	7–8	5–6	4	6	6
2nd "	7	7	8–10	6	4	7–8	6–7
3rd "	7	7	8–10	6–7	4	6–7	6–7
4th "	7	7	8–10	6–7	4	7	6–7
5th "	7	7	8–10	6	4	7	6–7
6th "	7	7	8–10	6	4	6	6
7th "	4	4	5	4	4	4	4
8th "	2	2	2	3	3	3	3

Key to the females of the seven adequately described species.

a Only 12 lobes to body margin on each side. . . . . *T. insularis* Morr.
aa 13-14 lobes to body margin on each side.
b Lobules of 2nd to 6th abdominal lobes not more than four. . . *T. trinidadensis* Morr.
bb Lobules of 2nd to 6th abdominal lobes six or more.
c Flabella short and rounded, at most hardly more than twice as long as broad.
d 8th abdominal lobe with two lobules; anterior abdom. segments with normally 7 or more lobules on each margin.
e Lobules of 2nd to 6th abdom. lobes not more than 7; flabella rounded. . . . . *T. mexicana* Silvestri.
ee Lobules of 2nd to 6th abdom. lobes 8 or more; flabella short clavate. . . . . *T. annandalei* Silvestri.
dd 8th abdominal lobe with 3 lobules; anterior abdom. segments with normally 6 or fewer lobules on each margin. *T. guianæ* Morr.
cc Flabella elongate, much more than twice as long as broad
f Flabella lanceolate, very acute at apex; 8th abdominal lobe with 3 lobules . . . . *T. panamensis* sp. n.
ff Flabella subcylindrical, rounded at apex or at most very obtusely pointed; 8th abdom. lobe with 2 lobules. *T. subafra* Silvestri.

Termitaradus panamensis sp. nov.

Male, female: Colour of alcohol specimens pale yellowish. Very similar save in details, to the Indian *T. annandalei* Silv., from which it differs in the smaller number of lobules on the marginal lobes, and in the shape of the flabella, which are elongate and lanceolate, the broadest part being nearer base than apex, the apex itself being very sharply pointed. The dorsal surface of the body is minutely papillated, marked into innumerable polygonal areas (chiefly irregular hexagons) by lines of slightly larger papillæ, and supplied with numerous pores. The tibial comb is similar to that described and figured by

Morrison in *T. guianæ.* The male genital segments differ from those of *T. annandalei*, especially in the caudal margin of the seventh abdominal segment, (mesad of the marginal lamina, see Silvestri, 1921, fig. III, 4) which is far less sinuate in the present species.

Length: male, 2.35; female, 2.40 mm.

Holotype (a slide mount) Type Cat. No. 27855 U. S. National Museum.

Allotype (slide mount, 13-lobed form). U. S. National Museum.

Paratypes in U. S. Nat. Mus. and in colls. Dr. W. M. Wheeler and Museum of Comparative Zoology.

Described from eight lots, with data as follows.—

5 males and 3 females, Barro Colorado Id., C. Z., Panama, 20th June, 1924, W. M. Wheeler. No. 510 (in nest of *Leucotermes convexinotatus* Snyder);

2 females, same locality, 21st Feb., 1924, T. E. Snyder. (in nest of *Leucotermes tenuis* Hag.)

3 females, same locality, 6th June, 1923, Zetek-Malino coll. (with *Leucotermes tenuis* on soft dry wood on ground) Z.2081

10 females, 2 males and 4 nymphs, near Fort San Lorenzo, C. Z., Panama, 14th June, 1923, J. Zetek, Z.2128A. (on soft wood of tree-stump);

3 females and two nymphs, same locality and date, J. Zetek, Z.2132A. (with *Leucotermes tenuis*);

1 female (Z.2171): In moist very soft rotting log on ground, Rio Aejeta, C. Z., Panama, Aug. 19th, 1923. With *L. tenuis* and *Cornitermes acignathus* Silv. J. Zetek coll.

1 female (Z.2263 S): In branch on ground, hard wet wood, Sweetwater, Fort Sherman, C. Z., Sept. 7th, 1923. With *L. tenuis.* Zetek-Malino coll.

3 females and one nymph (Z.2264 A) in pieces of branches on ground, hard wood. Other data as Z.2263 S.

Termitaradus guianae (Morr.)

Among the material kindly lent by the U. S. Bureau of Entomology through the courtesy of Mr. Morrison, were six females and one male from Rio Frio, Colombia, collected by Dr. W. M. Mann in February, 1924. These have been referred provisionally to *T. guianæ.* The male has twelve marginal lobes on each side, while five of the females have thirteen and the sixth shows fourteen. These seem all conspecific in spite of the divergence in the number of lobes. In this connection reasons have been adduced above for rejecting this character as specific among thirteen—and fourteen-lobed forms. Unfortunately the flabella are almost entirely lacking in the seven specimens, but the few that remain (fig. 13.) are identical in shape with those figures by Morrison in *T. guianæ.* Moreover the number of lobules in the respective lobes corresponds very closely with that in *T. guianæ*, the chief differences being as follows:

Number of lobules	*T. guianæ*	Colombian material
2nd lobe of mesothorax	4	5–6
2nd abdominal lobe	6	7
5th abdominal lobe	6	7

The variation in the considerable series of *T. panamensis* examined supports the suggestion that these differences come well within the range of intraspecific variability. In any case they seem an insufficient basis for specific rank.

In conclusion the writer would express his deep indebtedness to Professor W. M. Wheeler, Professor C. T. Brues and Mr. Nathan Banks for references to and loan of literature and for much helpful advice; and to Mr. Harold Morrison not only for turning over the task of describing his new species but also for much time, and patient work in demonstrating the interpretation of the segmentation.

Literature Cited.

CRAMPTON, G. C. 1923. Preliminary note on the terminology applied to the parts of an insect's leg. *Canad. Entom.* vol. 55, no. 6, pp. 126-132, Pl. 3.

KNIGHT, H. H., 1923. Miridæ: in, Hemiptera of Connecticut *Conn. State Geol. and Nat. Hist. Survey, Bull.* 34.

MJÖBERG, E., 1914. Preliminary description of a new representative of the family Termitocoridæ.
Ent. Tidskr., Uppsala, vol. 35, pp. 98-99, 2 figs.

MORRISON, H., 1923. Three apparently new species of *Termitaphis*. *Zoologica*, vol. 3, no. 20, pp. 403-408, Pl. 24.

PARSHLEY, H. M., 1921. Essay on the American species of *Aradus*. *Trans. Am. Ent. Soc.*, vol. 47, pp. 1-106, Pl. 1-7.

REUTER, O. M., 1912. Bemerkungen über mein neues Heteropterensystem.
Ofv. Finsk. Vet.-Soc. Forh., 54, A, no. 6, pp. 1-62.

SILVESTRI, F., 1911. Sulla posizione sistematica del genere *Termitaphis* Wasm. (Hemiptera) con descrizione di due specie nuove.
Portici Boll. Lab. Zool., vol. 5, pp. 231-236.

ibid., 1920. Contribuzione alla conoscenza dei Termitidi e Termitofili dell'Africa occidentale. *Op. cit.*, vol. 14, pp. 265-319.
(includes just a copy of the description and figures of *T. subafra* from Silvestri, 1911).

ibid., 1921. A new species of *Termitaphis* (Hemiptera-Heteroptera) from India. *Rec. Ind. Mus.*, Calcutta, vol. 22, pp. 71-74, 3 text-figs.

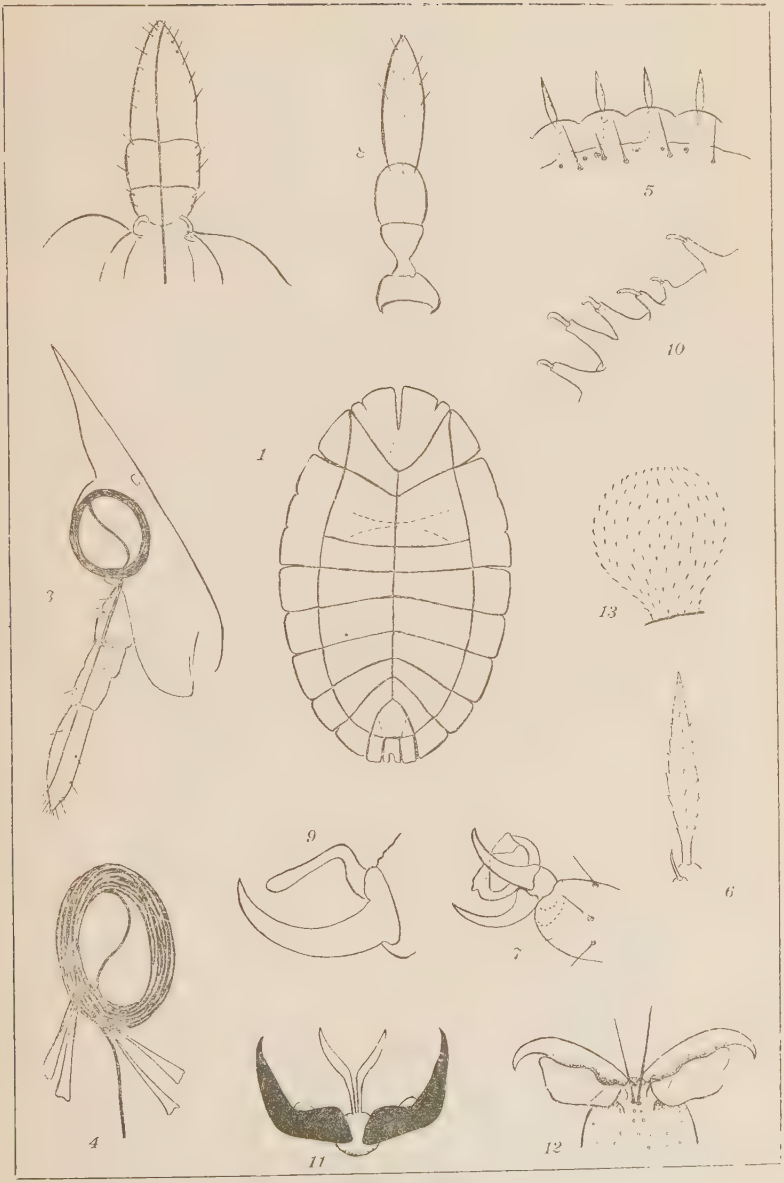
SPOONER, C. S., 1920. A note on the mouth parts of Aradidæ *Ann. Ent. Soc. Am.*, vol. 13, pp. 121-122, 1 text-fig.

TOWER, D. G., 1913. The external anatomy of the squash bug, *Anasa tristis* DeG. *Ann. Ent. Soc. Am.* vol. 6, pp. 427-441, Pl. 55-58.

WASMANN, E., 1902. Species novæ insectorum termitophilarum ex America meridionali.
Tijdschr. v. Ent., vol. 45, pp. 75-107; *Termitaphis*, p. 105, Pl. 9, fig. 7, 7a-c.

ibid., 1904. Res. Swed. Zool. Exped. to Egypt and White Nile, 1901; no. 13. Termitophilen aus dem Sudan. Pp. 1-21 taf. 1. Upsala.

ibid., 1911. Die Ameisen und ihre Gäste.
1st Congr. Int. d'Ent. Bruxelles, 1910. Pp. 209-234, Pl. 12-17.



MYERS—TERMITAPHIDIDÆ.

Figures.

1. *Termitaradus panamensis* sp. nov. Outline of body of female showing lobes and sutures.
2. Do. Rostrum projecting from body and viewed from behind.
3. Do. Lateral view of head showing rostrum, setal coil and insertion of left antenna.
4. Do. Setal coil, semi-lateral view.
5. Do. Portion of marginal lobe (pronotum, dorsal).
6. Do. Flabellum much enlarged.
7. Do. Tip of tarsus showing claws and arolia.
8. *Ctenoneurus hochstetteri* (Mayr). Rostrum.
9. Do. One claw and its associated arolium.
10. *Dysodius* sp., nymph. Portion of marginal lobe (pronotum, dorsal).
11. *Lygus vanduzeei* Knt. Claws, arolia and pseudarolia (after Knight).
12. *Euschistus variolarius* (Pal. de Beauv.). Tip of tarsus from below. The small circles are insertions of long spines. The arolia are united to the claws only at the base.
13. *Termitaradus guianæ* (Morr.) (Colombian specimen). Flabellum.

THE IMPORTANCE OF WINTER MORTALITY IN THE NATURAL CONTROL OF THE EUROPEAN CORN BORER IN NEW ENGLAND.[1]

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Among the factors that limit the spread and occurrence of an injurious insect in numbers sufficient to cause injury to crops, the ability of a species to withstand the rigors of winter occupies an important place, particularly in colder climates. If an insect is unable to pass successfully through this troublesome period of the year, it probably will rarely become a pest of first importance, although by means of annual migration it may occur frequently in some numbers. Such a condition is found, for example, in the case of the corn earworm (*Heliothis obsoleta* Fab.) which as far as our knowledge goes cannot successfully winter in New England or other northern sections of the United States. However, this insect appears nearly every summer in numbers ranging from a mere trace to serious abundance in such areas, and as the writer has shown, (Jour. Agri. Res. 1924, XXVII p. 65) it became a pest of importance in New England in 1921. The accepted explanation of this phenomenon is that the moths of this insect migrate northward each spring and summer, arriving in larger numbers some years than in others, and in the case of favorable growing seasons, possibly pass through a partial second generation, in which case injury is most noticeable.

It may happen in the case of another species that a large number of individuals may perish in the overwintering stage, more dying during severe winters than during mild winters. This too may result in the species becoming injurious during some seasons and unimportant during others following a high or low rate of mortality during the preceding winter.

Investigations of the European corn borer (*Pyrausta nu-*

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[1] Contribution from the Bureau of Entomology, U. S. Department of Agriculture in cooperation with the Entomological Laboratory of the Bussey Institution, Harvard University, (Bussey Institution No. 242.)

bilalis Hübn.) in the New England area have been conducted for several years to determine the importance of winter mortality as a limiting factor in the spread and injurious occurrence of this insect. It has been found that the spread of the insect has been greatest along the coast of New England and least inland from the sea. This condition may be due in part to an ability of the overwintering larvæ to survive more successfully along the coastal region where the winter temperatures due to the moderating effect of the ocean are less severe than farther inland where such a moderating effect is less noticeable. On the other hand no such condition may exist, and the more rapid spread along the coast may be the result of other causes.

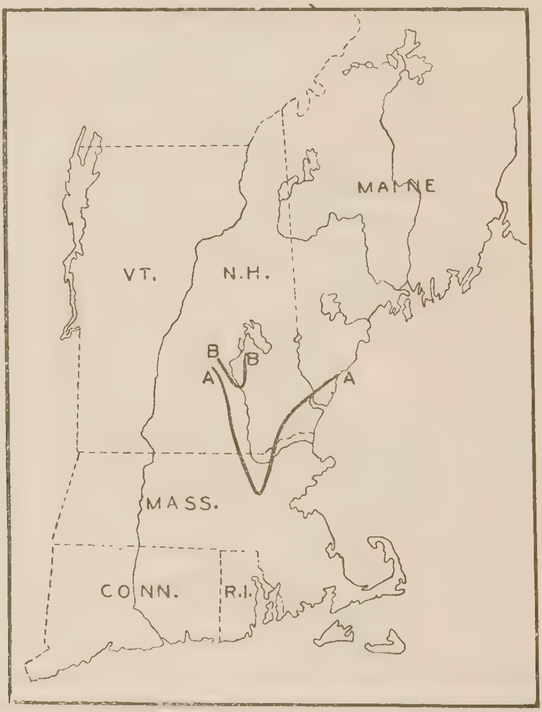

Fig. 1. Map showing the southern extent of the area of high winter mortality of the European corn borer in New England during the winters of 1922-1923 (AA) 1923-1925 (BB).

In the following account of winter mortality of the European corn borer, information has been obtained in two ways. Field counts of larvæ in the spring have usually been made in localities where the insect occurs abundantly and in host plants that have remained undisturbed. Over much of the area now infested in New England, however, the insect occurs in insufficient numbers to permit such counts in numbers large enough for accuracy. In this case experiments were placed in the field in representative localities in the fall after activity of the insect had ceased and collected in the spring before activity was resumed. In the studies of the results obtained in this work, the conditions found to exist in the spring of 1922, 1923 and 1924 may be considered separately.

Observations in the spring of 1922.

During the spring of 1922 observations of winter mortality were confined to host plants that had passed the winter undis-

TABLE No. 1.

WINTER MORTALITY FOUND IN THE SPRING OF 1922 IN SEVERAL HOST PLANTS THAT HAD PASSED THE WINTER UNDISTURBED.

Host Plant	No. of localities	Total No. larvae examined	No. larvae dead	Aver. % winter mortality	Greatest % winter mortality for any locality	Least % winter mortality for any locality
Sweet Corn.......	9	901	100	11.1%	16%	6.2%
Cocklebur (Xanthium sp.)....	5	644	33	5.1%	7%	2%
Barnyard Grass (*Echinochloa crus-galli* (L). Beauv).	4	273	30	10.9%	13%	10%
Smartweed (Polygonum sp.)...	2	150	4	2.7%	4%	0%
Beggar-ticks (Bidens sp.).......	2	210	16	7.6%	8%	0%
Pigweed (*Amaranthus retroflexus* L.)............	2	200	42	21%	27%	15%
Lamb's quarters (*Chenopodium album* L.)...........	1	100	8	8%	....	....

turbed. These observations were in corn and certain other host plants in which the insect occurs abundantly. The observations were also confined to that section of New England where the insect occurred in large numbers, an area bounded by Marblehead, Mass., on the north, Arlington, Mass. on the west and Quincy, Mass. on the south. The results of these observations are shown in Table I.

For all these localities and in all host plants the average winter mortality was 9.1 per cent, being highest in pigweed (*Amaranthus retroflexus* L.) and least in Cocklebur, (*Xanthium* sp.) and Smartweed (*Polygonum* sp.).

TABLE No. 2.

WINTER MORTALITY FOUND IN THE SPRING OF 1923 IN VARIOUS HOST PLANTS.

Host Plant	Number of Collections	Number of localities	Total number of larvae	Number larvae dead	Mean per cent larvae dead	Highest per cent dead-in any collection	Lowest per cent dead, in any collection
Sweet Corn........	50	20	5,150	415	8%	24.5%	1%
Beggar-ticks (Bidens sp.).............	9	7	800	66	8.2%	19%	0%
Pigweed (*Amaranthus retroflexus* L.).	9	5	850	119	14%	24%	7%
Horseweed (*Erigeron canadensis* L.)....	1	1	100	9	9%	......	...
Cocklebur (Xanthium sp.)..........	10	6	1,050	67	6.4%	15%	1%
Barnyard grass (*Echinochloa crusgalli* (L.) Beauv.)....	8	5	750	72	9.6%	20%	4%
Smartweed (Polygonum sp.).........	7	5	650	43	6.6%	18%	0%
Dahlia (Dahlia sp.)..	4	2	400	26	6.5%	12%	3%
Prince's feather (*Polygonum orientale* L.)...............	1	1	50	2	4%	......	...
Hemp (*Cannabis sativa* L.)..........	2	1	200	9	4.5%	7%	2%
Flase ragweed (*Iva xanthifolia* Nutt.).	1	1	100	17	17%	......	...

Observations in the spring of 1923.

Investigations of winter mortality during the spring of 1923 were of two distinct sorts; first, observations of the winter mortality in host plants that had remained undisturbed through the winter and second, observations of the winter mortality in corn stalks placed in representative localities the previous fall for the purpose of obtaining information on this subject.

In Table 2 the results of the observations of winter mortality in host plants that had remained undisturbed during the winter are shown. The highest rate of winter mortality was found in pigweed (*Amaranthus retroflexus* L.) and false ragweed (*Iva xanthifolia* Nutt.); the least mortality in prince's feather (*Polyfonum orientale* L.) and hemp (*Cannabis sativa* L.). These examinations were confined to localities within the heavily infested area of Massachusetts as were the corresponding observations of the preceding spring. The average winter mortality for all localities and host plants was found to be 8.3 per cent.

In table 3 winter mortality is compared in corn stalks that had passed the winter in various conditions. Here mortality appears to have been highest in corn stubble and lowest in corn that was piled up in the fall and passed the winter in this condition.

TABLE No. 3.

WINTER MORTALITY IN CORN STALKS THAT PASSED THE WINTER IN SEVERAL CONDITIONS.

Condition of corn stalks	Number of collections	Number of localities	Total number of larvae	Number of larvae dead	Mean per cent of larvae dead	Greatest winter mortality, in any collection	Least winter mortality, in any collection
Standing stalks.....	25	19	2450	186	7.6%	14%	1%
Stalks lying on surface of soil.......	12	10	1300	101	7.8%	13%	3%
Stalks placed in piles in the fall........	5	3	500	26	5.2%	12%	1%
Corn stubble.......	8	6	900	100	11.1%	24.5%	2%

None of the localities summarized in tables 2 and 3 were far enough inland to show any marked difference in winter mortality that might be associated with any climatic factor. In fact all these localities are in a very small area, somewhat larger than the area covered by the examinations of the previous year but confined to the heavily infested regions for the reason previously stated.

The experimental work, on the other hand, shows very clear differences in winter mortality. An experiment was placed in the late fall of 1922 in each of twenty localities representing all sections infested by this insect at that time. These experiments were placed in the field in November, 1922, after activity of the insect had ceased and were recovered in April, 1923, before spring activity began. Migration of larvae from the corn stalks was for this reason limited to a few individuals. Each experiment consisted of ten stakes to each of which were fastened six infested stalks. The findings in the spring of 1923 may be best shown in the following table.

TABLE No. 4.

WINTER MORTALITY FOUND IN THE EXPERIMENTAL MATERIAL IN THE SPRING OF 1923.

Locality	Date placed in field	Date re-covered	Total number of larvae re-covered	Number of larvae dead	Per cent of winter mortality	Average per cent of winter mortality in group
Bristol, N. H.	11–8–22	4–26–23	1397	307	41.9	35.5
Farmington, N. H.	11–7–22	4–25–23	1341	559	41.7	
Wells, Me.	11–7–22	4–25–23	1132	507	44.8	
Tyngsboro, Mass.	11–8–22	4–14–23	990	161	16.3	22.6
Concord, Mass.	11–4–22	4–10–23	854	256	29.8	
Methuen, Mass.	11–2–22	4–14–23	1014	52	5.1	3.9
Worcester, Mass.	10–26–22	4–11–23	1222	34	2.8	
Walpole, Mass.	11–6–22	4–11–23	661	32	4.8	
Quincy, Mass.	11–4–22	4–11–23	944	31	3.3	
Manomet, Mass.	10–30–22	4–6–23	1081	14	1.3	.88
Wareham, Mass.	11–1–22	4–8–23	1066	10	.9	
Falmouth, Mass.	10–31–22	4–7–23	1135	13	1.1	
Harwich, Mass.	11–1–22	4–6–23	909	9	1.	
Wellfleet, Mass.	10–31–22	4–7–23	1106	1	.09	

Several of the experiments placed in the field and recovered are not shown in this table because birds removed such a large number of the larvæ from the stalks that too few remained from which to draw conclusions. However, several areas stand out rather distinctly as showing considerable difference in the extent of winter mortality. First, an area represented by three stations in southern New Hampshire and Maine where winter mortality averaged 35.5 per cent; second, two localities in Massachusetts in inland river valleys where winter mortality averaged 22.6 per cent; third, four localities in eastern Massachusetts where mortality averaged 3.8 per cent; and fourth, five stations on Cape Cod where winter mortality averaged only .88 per cent.

Observations in the spring of 1924

In the fall of 1923 a series of experiments similar to those described for the previous year were placed in the field in the infested area of New England. As in the former instance the experiments were placed in the field in the fall after activity of the larvæ had ceased and they were recovered in the spring before activity commenced so that the loss through larval migration was expected to be limited to a few individuals. Each experiment consisted of four stakes to each of which were attached five infested corn stalks. The stations, 50 in number, were chosen in an attempt to represent the whole infested area in as fair a manner as possible. Using Arlington, Mass., as a center, these stations were run out in lines as far as the infestation was known to exist to the northeast, the north, the north by northwest, the northwest, the west, the southwest, the south and the southeast. On these stations 47 were recovered in good condition, 16 of which exhibited considerable feeding by birds. The average winter mortality of these 16 stations which were all located in Massachusetts was 1.7 per cent of the total number of larvæ recovered. The extent of winter mortality is shown in table 5. In this table the stations are grouped in three main divisions similar to those into which the area seemed to be naturally divided the previous spring.

TABLE No. 5.

EXTENT OF WINTER MORTALITY IN EXPERIMENTS EXAMINED IN THE SPRING OF 1923.

Maine and New Hampshire		Eastern Massachusetts		Cape Cod	
Per cent of winter mortality	Number of stations	Per cent of winter mortality	Number of stations	Per cent of winter mortality	Number of stations
1%	1	0%	2	0%	1
3 to 4%	3	less than 1%	7	less than 1%	1
4 to 5%	2	1 to 2%	2	1 to 2%	3
7 to 8%	2	2 to 3%	8	2 to 3%	1
8 to 9%	1	3 to 4%	3		
9%	1	4 to 5%	2		
24%	1	5 to 6%	3		
39%	1	6 to 7%	1		
		7 to 8%	1		
Average mortality 9.3% Average mortality omitting the two highest 5.4%		Average mortality 2.6%		Average mortality 1.3%	

Although the mortality was not nearly as extensive as it had been during the preceding winter, the same general conditions are noted; that is, a relatively higher rate of mortality at stations in Maine and New Hampshire and an extremely low rate on Cape Cod. Only two stations showed an important mortality—Concord, N. H. (39 per cent) and Bristol, N. H. (24 per cent). Why these stations should have shown extensive winter mortality while other stations in the same region did not, is a point not clearly understood. They were in more exposed locations, however, and may not have benefited by snow protection to so great an extent as the other stations.

The following table exhibits the protecting influence of snow as found in an experiment overwintering in Wells, Maine and examined April 28, 1923.

TABLE No. 6.

THE EFFECT OF SNOW PROTECTION ON THE EXTENT OF WINTER MORTALITY.

	Sweet Corn (24 stalks)			Longfellow flint corn (29 stalks)		
	Total No. of larvae	Number dead	% of winter mortality	Total No. of larvae	Number dead	% of winter mortality
Top foot of stalks........	130	67	51%	92	55	60%
Middle section of stalks...	435	190	43%	223	92	41%
Bottom foot of stalks.....	68	13	19%	49	13	26.5%

It is believed that the top of these stalks was exposed most of the winter, that the middle sections were exposed some of the time during the winter months and that the bottom foot was covered with snow during the whole period of severe winter weather.

Since it has been shown that the variation in winter mortality of this insect has been quite marked during the two winters, 1922-1923 and 1923-1924, it may be useful to examine the temperatures of the area covered by experiments during these winters. The extent of the area infested by this insect in New England is only some 80 miles east and west and about 175 miles north and south, while the extent of the injurious occurrence is only a small portion of this area. This is indeed a small area in which to study climatic conditions, but on the other hand, these conditions will be shown to be quite variable. There is considerable difference between the conditions on Cape Cod and the winter climate of the hills of Central New Hampshire where much more variable winter temperatures are experienced.

In tables 7 and 8 certain figures are presented for 15 localities throughout this larger area. These are divided into groups to correspond with the main sections of the area into which the results of the study of winter mortality seem to fall. Five localities represent the conditions of southern Maine and New Hampshire; three localities, the river valleys of northeastern Massachusetts; five localities, eastern Massachusetts and two localities

TABLE

SYNOPSIS OF WINTER TEMPERATURES

Locality	Elevation in feet	Precipitation (Total)	Minimum temperature	Date of minimum temp.	No. days minimum below 32°
Portland, Me	99	19.19	-8	Feb. 17	116
Plymouth, N. H.	500	10.47	-21	Dec. 20	117
Franklin, N. H.	440	11.06	-23	Jan. 7	118
Concord, N. H.	350	7.96	-14	Feb. 18	116
Durham, N. H.	88	12.27	-10	Dec. 20	112
Lawrence, Mass.	51	16.80	-13	Feb. 17	113
Lowell, Mass.	100	13.53	-18	Feb. 18	115
Concord, Mass.	139	14.79	-13	Feb. 17	108
Rockport, Mass.	25	12.33*	—4	Feb. 17	106
Fitchburg, Mass.	550	14.29	—9	Feb. 17	113
Worcester, Mass.	518	10.46	-3	Feb. 17	114
Boston, Mass.	124	10.06	2	Feb. 17	100
Fall River, Mass.	200	17.51	1	Feb. 24	104
Plymouth, Mass.	50	14.15	-2	Feb. 17	115
Provincetown, Mass.	40	15.95	8	Feb. 17 Mr. 29	99

*Record for March Missing.

TABLE

SYNOPSIS OF WINTER TEMPERATURE

Locality	Elevation in feet	Precipitation (Total)	Minimum temp.	Date of minimum temp.	No. days mini- below 32°
Portland, Me.	99	12.81	-18	Jan. 27	97
Plymouth, N. H.	500	11.26	-19	Jan. 27	110
Franklin, N. H.	440	9.67	-28	Jan. 28	114
Concord, N. H.	350	9.03	-18	Jan. 27	100
Durham, N. H.	88	12.95	-18	Jan. 27	101
Lawrence, Mass.	51	14.50	-14	Jan. 27	98
Lowell, Mass.	100	15.01	-18	Jan. 27	111
Concord, Mass.	139	13.40	-10	Jan. 27	105
Rockport, Mass.	25	13.15	-10	Jan. 27	84
Fitchburg, Mass.	550	11.49	-16	Jan. 27	99
Worcester, Mass.	518	11.20	-9	Jan. 27	100
Boston, Mass.	124	12.91	-6	Jan. 27	75
Fall River, Mass.	200	17.84	-2	Jan. 27	86
Plymouth. Mass.	50	11.39*	-3	Jan. 27	96
Provincetown, Mass.	40	13.25	2	Jan. 27	78

*Records for December Missing.

No. 7.

DECEMBER 1, 1922 TO MARCH 31, 1923.

No. days minimum below 0°	Total amount temp. below 32°	Total amount temp. below 0°	Greatest range in a 24 hr. period	Average daily range	Detail of greatest range in a 24 hr. period	Winter mortality averaged in groups	Number of localities
9	2204	33	38	15.3	36 to –2	33.5%	3
29	2826	235	39	19	44 to 5		
34	2980	300	51	23.2	33 to –18		
19	2399	106	45	18.5	35 to –10		
13	2269	66	44	18.9	35 to –9		
9	2084	68	48	19.3	36 to –12	22.6%	2
25	2404	201	46	22.6	36 to –10		
23	2366	141	49	20.4	37 to –12		
1	1359	4	33	14.8	41 to 8	3.9%	4
12	1999	39	42	18	36 to –6		
4	1718	7	31	13.2	35 to 4		
0	1347	0	37	14.7	42 to 5		
0	1410	0	37	15.5	42 to 5		
2	1701	3	36	17.5	54 to 18	.88%	5
0	987	0	24	11.9	36 to 12		

No. 8.

DECEMBER 1, 1923 TO MARCH 31, 1924.

No. days minimum below 0°	Total amount of temp. below 32°	Total amount of temo. below 0°	Greatest range in a 24 hr. period	Average daily range	Detail of greatest range in a 24 hr. period	Winter mortality averaged by groups	Number of localities
5	1430	55	48	14.5	36 to –12	9. %	12
11	2052	83	38	16.1	38 to 0		
22	2296	175	53	21.2	39 to –14		
9	1677	65	40	17.3	45 to 5		
3	1624	31	39	17.6	43 to 4		
6	1407	27	41	18	40 to –1	2.6%	29
10	1711	49	38	21.6	38 to 0		
8	1558	35	37	19.1	41 to 4		
1	940	10	35	15.3	45 to 10		
4	1409	32	39	17.7	59 to 20		
4	1241	17	34	14.2	28 to –6		
					55 to 21		
2	806	9	37	13.8	37 to 0		
1	892	2	25	14.4	25 to 0		
					33 to 8		
					37 to 12		
2	1126	4	32	16.8	42 to 10	1.3%	6
0	710	0	33	13.	45 to 12		

represent Cape Cod. The information contained in these tables has been computed from records of the United States Weather Bureau and information is restricted to localities for which this Bureau obtained detailed records during the periods covered by this study. The records were mostly of maximum and minimum daily temperatures, columns headed "total amount of temperature below 32 degrees" and "total amount of temperature below 0 degrees" being obtained by adding minimum temperatures experienced at each locality. The information contained in these tables is presented as comparisons between different localities and as a comparison of the two winters. They are not intended to show that any one set of factors explains the variation in winter mortality that was found in the several localities where experiments were placed.

Several interesting points may be noticed in a study of these tables; 1, the moderating effect of the sea is shown in those stations that are located on the sea coast *i. e.*, Portland, Me., Rockport, Boston, Plymouth and Provincetown, Mass. 2. In all localities the fact that the winter of 1922-1923 was severe in comparison to the mild winter of 1923-1924, is clearly indicated. The mortality rate for each winter is for the most part readily compared with this difference in severity. 3. A distinct correlation is shown for the winter of 1922-1923 between high percentages of mortality and winter severity.

It does not appear that a slow westward spread of this insect in New England is to be accounted for by winter mortality except that barriers of high mortality may in severe winters appear, such as was represented by Concord, Mass. during the severe winter of 1922-1923 when mortality there was found to be 30 per cent. Worcester, Mass., the station located farthest west in the experiments of 1922-1923 showed 2.8 per cent of mortality (table 1) and in the experiments of 1923-1924 the average winter mortality of the six stations located farthest west in Massachusetts was but 3.6 per cent.

To the north, however, it does seem that the insect may be entering territory in which it will suffer annual winter mortality sufficient to keep its numbers below that which would allow serious injury to crops, at least in certain areas. In Merriam's map of Life Zones of the United States (1910-Check-List of North American Birds, 3d ed., rev.; also published in separate form, Biol. Survey, U. S. Dept. Agr.) the Boreal region is shown to extend southward into central New Hampshire in the shape of a long arm. It is interesting to note that the experiments placed in Bristol, N. H. in the fall of 1922 showed the following spring 22 per cent of winter mortality and the material placed in the same location a year later and examined in April of 1924 showed winter mortality of 24 per cent. This town is located within the southern point of the boreal region referred to above and is the only locality that showed considerable winter mortality during each of the two years. Furthermore, the only other locality that showed a high percentage of mortality during the winter 1923-1924 (Concord, N. H. with 39 per cent of mortality) lies just without the southern edge of this region. This is the only area in New England where infestation by this insect is known to approach the boreal zone as portrayed in the map referred to. The information is not sufficient to warrant a prediction as to whether this insect would thrive in the Boreal zone, but it may be highly suggestive of a condition that may eventually be found to exist.

Summary.

The studies recorded in this paper were undertaken to determine what importance winter mortality played in the natural control of the European corn borer in New England. Examinations of several host plants of this insect in the spring of 1922 and the spring of 1923 showed that mortality was greatest in pigweed (*Amaranthus retroflexus* L.) and barnyard grass (*Echinochloa crusgalli* (L.) Beauv.), the mortality in pigweed averaging 21 per cent in 1922 and 14 per cent in 1923, while in barnyard grass 10.9 per cent were found dead in 1922 and 9.6 per cent perished in 1923. The average mortality in all host plants and localities was 9.4 per cent in 1922 and 8.3 per cent in 1923. All of these examinations were made in the heavily infested area of the New England infestation, bounded by Marblehead, Mass., on the north, Arlington, Mass., on the west and Quincy, Mass., on the south.

In the fall of 1922 and again in the fall of 1923 experiments consisting of corn stalks tied to stakes were set out in 20 localities the first year and 50 localities the second year, throughout the area known to be infested by this insect in New England. The results obtained by the examination of these experiments in the spring of 1923 and the spring of 1924 showed somewhat greater mortality during the winter of 1922-1923 than during the winter of 1923-1924. Winter mortality was found to be greater in localities farther north than in localities in the southern part of the infested area. Thus on Cape Cod, 5 localities averaged 0.88 per cent of mortality in the spring of 1923 and 6 localities averaged 1.3 per cent of mortality in the spring of 1924: In the remainder of the infested area in Massachusetts, 4 localities not in river valleys averaged 3.9 per cent of mortality, and 2 localities in river valleys averaged 22.6 per cent of mortality in the spring of 1923, while 29 localities averaged 2.6 per cent of mortality in the spring of 1924. In the infested area of Maine and New Hampshire 3 localities averaged 33.5 per cent of mortality in the spring of 1923 while 12 localities averaged 9.3 per cent of mortality in the spring of 1924.

From a study of winter weather of 15 localities representing the entire invested area, no one factor alone seems to be responsible for winter mortality, but the extent of mortality seems to be associated with winter severity. While winter mortality seems to be of minor importance in the area infested by the European corn borer in New England at the present time, areas of rather high mortality have appeared, and these must play some part in limiting the advance and increase of the infestation in such localities.

ON SOME NEW PHLŒOTHRIPIDÆ (THYSANOPTERA) FROM THE TRANSVAAL

By J. Douglas Hood,

University of Rochester.

The new species described below constitute only a very small part of a collection of Thysanoptera made in the Transvaal by Mr. Jacobus C. Faure, Professor of Entomology in the Transvaal University College, at Pretoria. The descriptions were prepared early in 1924, before I learned that Mr. Faure had himself decided to work up the Thysanoptera of Southern Africa, and while I was engaged in special studies of the genera to which they belong. It is to be hoped that Mr. Faure will soon publish his interesting observations on the group.

Compsothrips recticeps sp. nov.

Female (apterous).—Length about 2.9 mm. Color nearly black, with posterior margin of pterothorax, first abdominal segment, sides of second segment, and a pair of lateral blotches on fifth segment, white; trochanters, and hind coxæ, brown; antennæ nearly black, excepting apical portion of segment 2, which is brownish yellow, and segment 3, which is brownish yellow and heavily shaded with blackish brown near base and at apex; subhypodermal pigmentation purple.

Head 2.3 times as long as wide, broadest across eyes, surface nearly smooth, lightly reticulate at base; cheeks nearly parallel in anterior three-fifths, slightly converging posteriorly; anterior prolongation of head with sides slightly converging anteriorly; vertex flattened, sloping downward, and with a slight median ridge in lower portions; frontal costa slightly concave; three pairs of short, knobbed bristles on head, the anterior pair longest and situated near anterior angles of eyes, the middle pair just in front of posterior margins of eyes, the posterior pair well down on cheeks and somewhat more than twice their length behind eyes. Eyes protruding, less than one-fourth as long as head and less than one-half as wide as their interval. Ocelli wanting. Antennæ about one and one-third times as long as head; segment 3 about equal to 1 and 2 together and 1.4 times the length of 4; 4-7 prolonged ventrally[1] at apex, 4 and 7 only slightly; all bristles and sense cones particularly short and weak. Mouth cone shorter than its width at base, about reaching middle of prosternum, broadly rounded at apex, tip of labrum not attaining that of labium.

Prothorax less than one-half as long as head and (inclusive of coxæ) about 1.6 times as wide as long, surface nearly smooth, with sides and the abruptly declivous posterior margin lightly subreticulate; midlaterals minute, all other bristles present, brownish yellow, knobbed and about equal to postoculars and coxals. Pterothorax very small, decidedly narrower than prothorax; mesoscutum transversely striate with anastomozing lines, becoming subreticulate at sides; metascutum subreticulate at sides and base, rather closely longitudinally striate elsewhere. Wings wanting. Legs long and slender, with femora and tibiæ (particularly those of posterior legs) arcuate; fore tarsi armed with a long, stout tooth.

Abdomen broad and heavy, fully 1.5 times as wide as prothorax. Tube less than half as long as head and about twice as long as basal width, which is twice the apical. Bristles nearly colorless, long, nearly pointed; terminal bristles brownish, about 0.7 as long as tube.

Measurements of holotype (♀): Length 2.90 mm.; head, length 0.593 mm., width (across eyes) 0.257 mm., width at base 0.204 mm.; eyes, length 0.128 mm., width 0.060 mm., interval 0.135 mm.; prothorax, length 0.255 mm., width (inclusive of coxæ) 0.408 mm.; pterothorax, width 0.330 mm.; abdomen, width 0.638 mm.; tube, length 0.249 mm., width at base 0.126 mm., at apex 0.061 mm.

Antennal segments:	1	2	3	4	5	6	7	8
Length (μ)	84	90	170	119	115	102	63	60
Width (μ)	57	43	44	45	41	38	31	20

Total length of antenna 0.80 mm.

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[1] Several genera of Phlœothripidæ have certain of the intermediate antennal segments prolonged in this way, and the teeth so formed are set with a series of short, sensory bristles. Various entomologists have described these teeth as being situated on the *dorsal* surface of the antennæ, whereas they are clearly *ventral* in position.

Described from 2 females taken by Mr. J. C. Faure at Duivelskloof, Transvaal, December 7, 1918, "on grass" (No. 407).

The coloration of the antennæ and body associate this species with *C. albosignatus* (Reuter) from which it differs most conspicuously in the much shorter third antennal segment and the shape of the head.

Stictothrips gen. nov.

(*Stiktos*, spotted; *thrips* a wood worm)

Depressed; roughened, non-shining and mottled above; glabrous beneath. Head not elongate, rounded but not swollen behind eyes, narrowed at base; cheeks with several prominent funnel-shaped bristles; vertex with a cup-like depression or groove, with the anterior ocellus at its upper edge. Eyes large, rounded and closely facetted, dorsal extent much greater than ventral. Fore femora not enlarged nor toothed; fore tarsi armed in both sexes. Wings of fore pair broad at base, abruptly constricted at basal two-fifths, apical three-fifths narrow, parallel-sided, delicately but distinctly reticulate, without median vein. Abdomen with a broad dorsal furrow for the reception of the wings. All prominent body bristles fan-shaped. Terminal bristles shorter than tube, pointed.

Genotype: *Phlœothrips maculatus* Hood.

Closest to *Neurothrips*, even to the general plan of coloration and the habits of the two known species, but separable by the absence of the median vein of the wing, the less swollen cheeks, and the short terminal bristles.

Stictothrips faurei sp. nov.

Female (macropterous).—Length about 1.6 mm. Color (to naked eye or as seen under hand lens) pale yellowish brown, intricately mottled with white and brown, with head, pterothorax, and tube dark brown, and appendages annulate with blackish brown. Under 16 mm. objective, the color appears paler—more nearly brownish yellow; head pale brown, vertex yellow, a narrow, median brown streak on dorsum of head behind eyes, and a small, white, lateral spot at extreme base, cheeks narrowly edged with brown; antennæ straw-yellow, with segments 4, 6 and 8 dark blackish brown, except pedicel and apex of 4 and pedicel of 6, which are yellow, and outer surface of 1, inner and outer surfaces of 2, pedicel of 3, and sides and apical portion of 7, which are shaded with brown; prothorax pale straw-yellow, anterior plate at hind angles brown, posterior plate white, coxæ and ventral plates brown; pterothorax with sides brown and darkest posteriorly, dorsum paler, brownish yellow; mesoscutum with anterior angle white and a dark brown blotch on posterior margin at middle; metascutum with a pair of tooth-like dark brown blotches directed posteriorly, their points paler, and nearly or quite touching; legs pale yellowish, with tarsi nearly black, tibiæ broadly ringed with dark brown just before middle, and femora with a dark brown blotch on inner, and one on outer, surface; wings colorless or lightly clouded with yellowish; segment 1 of abdomen yellowish, with a median, pale brown blotch, and with the pair of small plates at base dark brown; remaining segments (excepting 8-10) with a pale brown blotch at middle, with a white one on either side, followed by a dark brown one (much the largest on segment 2), and at extreme lateral margins, by a small pale brown one, the area in front of the latter white, all blotches becoming less distinct on the more posterior segments; segment 8 with two pairs of small brown spots, arranged in a transverse row, the outer pair involving the stigmata; 9 with two pairs of small brown spots, arranged in two longitudinal rows; tube dark blackish brown apically and at sides of base, remainder pale yellow.

Head about 1.1 times as long as wide, broadest behind eyes, converging to base, the latter about 0.8 the greatest width, dorsal and ventral surfaces lightly reticulate (not clearly visible in all specimens), cheeks minutely serrate and set with about five pairs of transparent, trumpet-shaped bristles; vertex with a cup-shaped depression, the anterior ocellus located on upper margin of cup and directed forward; sides of head in front of eyes produced anteriorly to form a pair of strong teeth slightly overhanging outer margin of first antennal segment. Eyes large and rounded, very closely facetted, prolonged posteriorly on dorsal surface of the head.[1] Ocelli exactly equidistant, pigment red. Antennæ almost exactly as figured in the original description of the genotype, but more slender (see measurements) and without infundibuliform bristles at base of segment 2 and apex of segment 3; sense cones as in figure of that species. Mouth cone acute, about attaining posterior margin of prosternum, labrum acutely pointed.

Prothorax somewhat more than half as long as head and (inclusive of coxæ) nearly 2.4 times as wide as long, surface finely granulate; all usual bristles present, broadly dilated, fan-like, so transparent as to be easily overlooked; posterior plate at hind angles with two bristles, instead of one, the posterior bristle the largest on prothorax. Pterothorax wider than prothorax, sides subparallel for half their length, then roundly converging to base of abdomen. Wings of fore pair sharply constricted near middle, where there is a short median thickening; basal portion without fringe on anterior margin, but with about 8 minute hairs in outer portion of posterior margin; distal portion of wing rather sparsely fringed, without accessory hairs; entire wing roughened and lightly but distinctly reticulate; subbasal bristles set close to base of wing, minute, expanded. Legs short, fore and hind femora swollen, fore tarsi with a long, slender, hooked tooth; leg bristles mostly expanded apically.

Abdomen distinctly broader than prothorax. Tube nearly two-thirds as long as head, unusually slender, more than three times as long as basal width which is hardly twice the apical, slightly widened at base, sides slightly converging apically. Bristles broad, nearly clavate, almost transparent, the lateroventral pair on segment 9 longer and pointed; terminal bristles yellowish, hardly twice as long as tube.

Measurements of holotype (♀): Length 1.55 mm.; head, length 0.252 mm., width 0.221 mm., width at base 0.182 mm.;

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[1] In the original description of *S. maculatus* (Hood), Entomological News, XX, 1909, p. 250, the eyes are said to be reniform, and are so shown in the figure given on page 251. As the wings of the unique type had not been spread, and as the coloration was so dark as to make difficult any detailed study of the chitinous exoskeleton, the writer ventured to clear the specimen in potassium hydroxide and remount it; and subsequent study shows the eyes to be broadly rounded posteriorly, and not at all reniform. Only the type is known.

eyes, length 0.111 mm., width 0.065 mm., interval 0.084 mm.; prothorax, length 0.135 mm., width (inclusive of coxæ) 0.323 mm.; pterothorax, width 0.350 mm.; abdomen, width 0.540 mm.; tube, length 0.161 mm., width at base 0.050 mm., at apex 0.029 mm.

Antennal segments:	1	2	3	4	5	6	7	8
Length (μ)	48	69	78	61	57	51	44	39
Width (μ)	30	32	28	31	28	26	21	11

Total length of antenna 0.45 mm.

Male (macropterous).—Apparently similar to female in all respects, excepting for the smaller size and slenderer form.

Described from 11 females and 7 males taken by Mr. J. C. Faure at Malelane, Transvaal, December 12, 1918, "on pawpaw tree trunk" (No. 403).

A particularly beautiful species, quite distinct from its North American congener, and one which I take pleasure in naming after its discoverer.

Plectrothrips atactus sp. nov.

Female (brachypterous).—Length about 1.8 mm. Color pale brownish yellow, shaded with blackish brown on front margin of head, cheeks, posterior margin of prothorax, mesothorax (particularly at sides) and second abdominal segment; tube with a reddish cast; legs and antennæ yellow; no subhypodermal pigmentation except the three, bright-red, ocellar spots.

Head smooth above, roughened at sides, 1.2 times as long as wide, broadest midway between eyes and base of head, cheeks rounded; postocular bristles pointed, much shorter than eyes, almost lateral in position; other cephalic bristles minute. Eyes moderately small, hardly one-third as long as head and about 0.4 as wide as their interval. Ocelli situated far forward, the anterior one almost between bases of antennæ, the posterior pair very widely separated, situated close to anterior angles of eyes. Antennæ of structure normal to the genus[1], except that

[1] See Hood, Ins. Insc. Menstr., Vol. IV, 1916, Pl. 1, fig. 4.

segment 8 is more slender than usual and distinctly the longest in entire antenna, and segment 6 has no long sense cone on the outer surface at apex. Mouth cone shorter than wide, broadly rounded at apex.

Prothorax smooth, about equal in length to head and (inclusive of coxæ) about twice as wide as long, notum not attaining lateral margins, median thickening distinct; one pair of pointed bristles at posterior angles, somewhat longer than postoculars and subequal to coxals; other bristles minute. Pterothorax about as wide as prothorax. Wings short and scale-like. Legs short and stout; fore tibiæ not toothed on inner surface of apex; middle and hind tibiæ with the usual long stout spines; fore tarsus with a long, curved tooth.

Abdomen of normal structure; tube 0.7 as long as head and about twice as wide at base as at apex, sides slightly concave, apex slightly constricted. Bristles long and pointed; terminal bristles much shorter than tube.

Measurements of holotype (♀): Length 1.83 mm.; head, length 0.230 mm., width 0.191 mm.; eyes, length 0.070 mm., width 0.039 mm., interval 0.096 mm.; postocular bristles, length 0.057 mm.; prothorax, length 0.198 mm., width (inclusive of coxæ) 0.390 mm.; pterothorax, width 0.390 mm.; abdomen, greatest width 0.456 mm.; tube, length 0.165 mm., width at base 0.086 mm., at apex 0.046 mm.

Antennal segments:	1	2	3	4	5	6	7	8
Length (μ)	49	63	58	60	56	55	55	67
Width (μ)	44	43	43	44	36	31	24	14

Total length of antenna 0.46 mm.

Male (brachypterous).—Similar to female except for the somewhat smaller size, slenderer abdomen, and the more enlarged prothorax and fore legs. Ninth abdominal tergite slightly prolonged at middle of posterior margin to form a thin, semicircular plate overlying the tube.

Described from 20 females and 5 males taken by Mr. J. C. Faure at Boksburg, Transvaal, April 21, 1914, "under dead Eucalyptus bark" (No. 401).

The long terminal segment of the antenna and the absence of the usual sense cone from the outer surface of the sixth antennal segment should serve to distinguish this species. The structure of the 9th abdominal tergite of the male is interesting. The same process occurs in *P. antennatus* Hood but is lacking in *P. pallipes* Hood.

Trichothrips transvaalensis sp. nov.

Female, forma brachyptera.—Length about 1.7 mm. Color brown, with pterothorax somewhat lighter and head yellow; femora concolorous with body, except fore pair, which are yellow apically; tibiæ paler than femora, mid and hind pairs shaded with brown; tarsi yellow; tube brown, paler at extreme base and in apical half; antennæ dark blackish brown, excepting segments 1, 2 and 3, which are pale brown, with base of 1, apex of 2 and pedicel of 3 pale yellow; subhypodermal pigmentation red.

Head slightly longer than broad, widest at middle of cheeks, abruptly rounded to eyes and slightly converging to base of head; occipital region faintly subreticulate and with the usual bristles on cheeks rather stout and prominent; postocular bristles less than half as long as head, pointed. Eyes small, directed forward, less than one-fourth the length of the head, and about five-eights as wide as their interval. Ocelli usually wanting, but sometimes minute and barely visible, in which case the anterior one is situated well down toward antennæ, and the posterior ones opposite middle of eyes. Antennæ distinctly more than twice the length of the head; segment 1 tapering to apex; 2 much longer and narrower than 1; 3 the longest, subconical; 4-8 successively shorter and narrower; 8 lanceolate, pedicellate, pedicel somewhat dilated at base; sense cones: 3, 1-2; 4, 2-2; 5, 1-1+1; 6, 1-1+1; 7 with one on dorsum near apex. Mouth cone reaching nearly across prosternum, semicircularly rounded at apex, tip of labrum about attaining that of labium.

Prothorax nearly 0.9 as long as head and (inclusive of coxæ) about twice as wide as long; anterior marginal and anterior angular bristles about half as long as postoculars; others long, pointed, midlaterals and inner pair at posterior angles about as long as postoculars, the other pair shorter but longer than coxals.

Pterothorax about as wide as prothorax, sides almost parallel. Wings minute. Fore tarsus with a moderately long, stout tooth.

Abdomen broad, 1.4 times as wide as prothorax. Tube about 0.8 as long as head, about twice as long as basal width, and distinctly more than twice as broad at base as at apex. Bristles long and pointed, those on the ninth segment somewhat shorter, subequal to terminal bristles, two-thirds as long as tube.

Measurements of holotype (♀): Length about 1.74 mm.; head, length 0.228 mm., greatest width 0.209 mm., width at base 0.188 mm.; eyes, length 0.052 mm., width 0.048 mm., interval 0.081 mm.; postocular bristles, length 0.090 mm.; prothorax, length 0.200 mm., width (inclusive of coxæ) 0.408 mm.; pterothorax, width 0.413 mm.; abdomen, width 0.573 mm.; tube, length 0.180 mm., width at base 0.091 mm., at apex 0. 043 mm.

Antennal segments:	1	2	3	4	5	6	7	8
Length (μ)	54	67	78	71	66	62	51	48
Width (μ)	45	32	35	34	31	30	26	18

Total length of antenna 0.50 mm.

Female, forma macroptera.—Head concolorous with body, instead of yellow; eyes much larger, rounded, their width nearly equal to their interval; ocelli large, the anterior one situated in front of eyes and overhanging; pterothorax broader than prothorax; wings broad, colorless, fore pair with 8 or 9 accessory hairs on posterior margin; outer subbasal bristle on fore wings short and pointed, others three times as long and capitate.

Male (brachypterous).—Only slightly smaller than female and quite similar in general structure; fore femora greatly swollen, tarsal tooth much stronger, nearly triangular.

Described from 30 females and 20 males, taken by Mr. J. C. Faure at Johannesburg, Transvaal, April 21, 1914, under dead Eucalyptus bark (No. 404).

A true *Trichothrips*, with the terminal antennal segment pedicellate. Separable from its congeners by the coloration, the rather long third antennal segment, and the details of chætotaxy.

THE IDENTITY OF LEPTOFŒNUS F. SMITH AND PELECINELLA WESTWOOD (HYMENOPTERA).

BY CHARLES T. BRUES.

Bussey Institution, Harvard University.

In 1862 Frederick Smith[1] described as Leptofœnus a peculiar Hymenopterous insect of doubtful affinities which he says unites some of the characters of Fœnus (Gasteruption), Megischus and Pelecinus). A recent examination of this paper led me to compare his description with a specimen of the remarkable chalcid-fly Pelecinella, and I find that the two are undoubtedly synonomous. As the Leptofœnus (1862) antedates Westwood's Pelecinella (1868), Smith's name must take precedence.

These insects are now generally conceded to form a part of the family Cleonymidæ although they constitute a very aberrant group represented, so far as is known, only in the neotropical region from Brazil to Panamá

SUBFAMILY LEPTOFOENINÆ HANDLIRSCH.
GENUS LEPTOFOENUS SMITH.

Type: *L. peleciniformis* Smith
1862 F. Smith, Trans. Entom. Soc. London (3) vol. 1, p. 43 ♀ (*Leptofœnus*)
1868 Westwood, Trans. Entom. Soc. London, Proc., p. XXXVI (*Pelecinella*)
1874 Westwood, Thesaur. Entom. Oxon., p. 142 Pl. XXVI, fig. 8 (*Pelecinella*)
1889 Schletterer. Berliner Entom. Zeits., vol. 33, p. 239 (*Leptofœnus*)
1895 Ashmead, Proc. Enton. Soc. Washington, vol. 3, p. 232 (*Pelecinella*)
1902 Dalla Torre, Catalogus Hymenopterorum, vol. 3, p. 1075 (*Pelecinella*).
1903 Szépligeti, Ann. Mus. Nat. Hungarici, vol. 1, p. 365 (*Leptofœnus*).

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[1] Trans. Entom. Soc. London, (3), vol. 1.

1904 Ashmead, Mem. Carnegie Mus. Pittsburgh, vol. 1, p. 285, p. 384, p. 486 (*Pelecinella*)
1909 Schmiedeknecht. Genera Insectorum, fasc. 97, p. 150 (*Pelecinella*)
1910 Kieffer, Evaniidæ, Das Tierreich, Lief. 30, p. 410 (*Leptofœnus*)
1912 Viereck, Bull. U. S. Nat. Mus., No. 83, p. 84 (*Leptofœnus*).
1915 Brues, Psyche, vol. 22, p. (*Pelecinella*)
1923 Gahan & Fagan, Bull. U. S. Nat. Mus., No. 124, p. 112 (*Pelecinella*)
1924 Handlirsch, Schröder's Handbuch der Entomologie, vol. 3, p. 744 (*Leptofœnus*); p. 764 (*Pelecinella*)

As already stated Smith ('62) did not locate his genus Leptofœnus in any family, and as his remarks concerning it preclude its association with the Chalcidoidea, Westwood ('68) placed his Pelecinella there without suspecting its identity. Schletterer ('89) quoted Smith's description and speculated concerning the relationships of Leptofœnus, but made no attempt to locate it in any family. Ashmead ('95) transferred Pelecinella to the family Cleonymidæ, considering it better placed there than in the Torymidæ (Callimonidæ) where Westwood had first ('68) placed it, or in the Perilampidæ where it is located in Westwood's "Thesaurus." Since then no one has seen fit to suggest relationship with any other Chalcidoids. Kieffer ('10) includes Leptofœnus in the Evaniidœ where it is placed at the end of the subfamily Aulacinæ. Finally Handlirsch ('24) has erected a new family for Leptofœnus, placing it between the Stephanidæ and Megalyridœ, and in the same volume he includes Pelecinella as the tribe Pelecinellini of the subfamily Cleonyminæ of the Chalcididæ, not suspecting any relationship between the two genera.

The checkered taxonomic career of Leptofœnus thus illustrates well the great difficulty which attends the allocation of aberrant insects on the basis of descriptions.

The five described species of Leptofœnus are all very closely similar although differing strikingly in color. The type species, *L. pelecciniformis* Smith seems to be most closely similar to *L. ashmeadi* Brues from Brazil, although undoubtedly distinct.

Since this was written I have seen a specimen of Leptofœnus from Panama. This is a female found by Prof. W. M. Wheeler on Barro Colorado Island in the Canal Zone, where it was seen in company with several others on the bark of a felled Cordia tree. Contrary to expectations, however, this is evidently not Smith's species, but appears to be a variety of *L. westwoodi* Ashmead described originally from Brazil. It differs conspicuously from the latter in color, lacking the rufous markings which are replaced by black, but agrees so well otherwise that I believe it to be only a well marked color variety of that species.

NOTES ON THE GENUS NECTARINA SHUCKARD. (VESPIDÆ).

By Cedric Dover.

British Museum (Natural History), London, England.

The following notes are based on material in the British Museum (Natural History).

Nectarina championi sp. nov.

Female: head black, remotely punctured, covered with very short golden pubescence; genæ yellow, the yellow extending on to the occiput just behind the middle of each posterior ocellus; eyes dark greenish-bronze with golden iridescence; antennæ mostly ochraceous, lighter on the underside, flagellum on outerside, except the three apical joints, brownish-black; clypeus yellow, usually with two, short, longitudinal indefinitely shaped, brownish markings, convex, broader than long, posterior margin emarginate, anterior margin acutely prolonged; supra-clypeal area with a band of yellow, posteriorly notched with black in the middle; two more or less rounded yellow markings on the frons adjacent to the base of the antennæ and a small transverse yellow marking above these; mandibles yellow; pronotum yellow with short golden brown hairs arising from minute punctures; mesonotum black, sparsely, but regularly and finely, pitted, with a longitudinal median carina anteriorly, and two, yellow curved-in stripes extending across it longitudinally on each side of this carina; scutellum yellow, pitted,

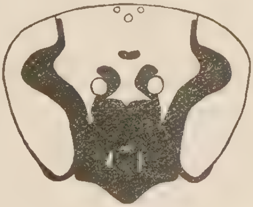

Fig. 1. *Nectarina championi* sp. nov. Front view of head; yellow markings indicated in black.

having a rather coarse appearance, broadly grooved down the middle; post-scutellum yellow, slightly narrower than scutellum, sides parallel, anterior margin transverse, posterior margin rounded, shining and almost impunctate; median segment yellow, much broader than long, broadly and shallowly excavated down the middle, more or less impunctate, with comparatively long golden-brown hairs on the sides; abdomen ochraceous-brown, posterior margin of second segment, and succeeding segments, ochraceous, the first two segments with hairs arising from fine punctures, which lie along them closely longitudinally adpressed, giving them a finely striated appearance; succeeding segments very closely punctate with short golden hairs arising from them; legs ochraceous; with short golden pubescence on the tibiæ and tarsi; wings iridescent-hyaline, nervures brown; tegulæ ochraceous.

Length: 6 millimetres.

Habitat: David, Chiriqui, Panama (*G. C. Champion*).

Holotype and twenty-eight paratypes in the British Museum.

The small size and ochraceous color of this species makes it so distinct from the other species of the genus known to me that it is unnecessary to institute a comparison.

Nectarina scutellaris Fabr.

Additional records: Corcovada, Rio de Janeiro (*G. E. Bryant*, 10. v. 12); Guaruja, Ilha Santo Amaro (*G. E. Bryant*, 9. iv. 12); Santarem; Sao Paulo; Issororo, British Guiana (*G. E. Bodkin*, Jan. 1912).

Nectarina azteca Suass.

In the British Museum from the following Mexican localities: Oojaca; Amula, Guerrero, 6000 feet; Hacienda de la Imagen, 6000 feet; Tierra Colorada, Guerrero, 2000 feet; Rincon; Acapulco; Etat de Puebla, Jehuacan.

Nectarina augusti Sauss.

Additional records: Parintins, Lower Amazon (*E. E. Austen*, 4. xi. 96); La Guayra, Venezuela, 1-200 feet (*G. B. Longstaff*, 20. xii. 06).

Meade-Waldo (A. M. N. H. ser. 8, vii, p. 112, 1911) gives *Chartergus amazonicus* Cam. specific rank. but as Ducke has shown (Ann. Mus. Nat. Hung., viii, p. 481, 1910) Cameron's insect is a synonym of *N. augusti* Sauss.

Nectarina bilineolata var. **smithii** Sauss.

Additional records: El Reposo, 8000 feet (*G. C. Champion*); S. Geronimo (*G. C. Champion*); Parintins, Lower Amazon (*E. E. Austen*, 4 xi96); "West Indies" (*E. F. Becher*).

Nectarina lecheguana var. **velutina** Spin.

The following localities for this form appear to be worth recording: Oojaca; Mazatlan; Xucumantlan, Guerrero, 7500 feet; Acaguizotla, Guerrero, 3500 feet; Tepetlapa, Guerrero, 3000 feet; Chilpancingo, Guerrero, 4600 feet; Rincon, 2800 feet; S. Geronimo; Orizaba; Atoyac; Bugaba, Panama; Teapa, Tabasco; V. de Chiriqui, 25-4000 feet; Chontales, Nicaragua; Issororo (*C. B. Williams*, July, 1916); Sta. Catharina; Puerto Bertoni, Paraguay. Mr. G. E. Bryant has taken the typical form at Estancia Biscacheras near Santa Elena, Entre Rios (25, 8, 12). Cameron's *Chartergus centralis* is a synonym of this form, as is also his *aztecus*, needlessly renamed *cameroni* by Meade-Waldo (*loc. cit.*), as Ducke had already established its identity (*loc. cit.*).

THE MALE OF THE PARTHENOGENETIC MAY-FLY, *AMELETUS LUDENS.*

By James G. Needham.

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This paper is to record the capture of a single adult male specimen of *Ameletus ludens* and to describe it. This sex has been sought diligently for more than a dozen years by a number of competent students of the Ephemerida, and many hundreds of nymphs have been reared in a vain effort to obtain it. Females are common enough at Ithaca, N. Y. The nymphs live in the pools of the rapid brooks that run down East Hill into Cayuga Lake. They poise gracefully on submerged twigs, or dart rapidly about over the sandy bottom. and are easily collected in April and May. Dr. W. A. Clemens found a single male sub-imago and took it into the laboratory but it died before its final moulting (Canad. Ent. 54: 77-78, 1922). On June 9, 1924, Dr. O. A. Johannsen captured a single adult male in flight by the side of Vanishing Brook near his home on Cornell Heights, and turned it over to me for study.

The nymph of this species was briefly described and beautifully figured by Eaton in his Monograph (Trans. Linn. Soc. Lond. (2) 3: 204, pl. 49) in 1885: it was doubtfully (and, as we now know, incorrectly) referred to the genus Chirotenetes, whose nymph was then unknown. The specimen had been collected in 1874 by Mr. Hubbard at Trenton Falls, N. Y. Female subimagos taken by Mr. D. B. Young in transformation at Newport, N. Y. were described by me in 1905 (N. Y. State Mus. Bull. 86: 36).

Males of the other species of Ameletus, all of which come from the Rocky Mountains or farther westward, are well known. The search for the male of this species was begun by Miss Anna H. Morgan. In 1911 she described the adult female (Ann. Ent. Soc. Amer. 4: 118) and gave a detailed report of rearings of scores of nymphs taken at Ithaca, N. Y., all of which were females. She first pointed out that here is a case of probable parthenogenesis. Two years later she described and figured the curiously sculptured egg (Ann. Ent. Soc. Amer. 6: 400, Pl. 52, fig. 59, 1913); and she continued to rear the nymphs without finding a single male. I have myself, also, reared scores of nymphs—all females. Clemens examined hundreds of nymphs and found them all females. He demonstrated parthenogenesis by taking the eggs of these females, reared in isolation from males and unmated, and hatching them. He found the period of incubation to be five months (1. c., p. 78).

I have recently come upon this same marked tendency toward parthogenesis in the genus Ephemerella. In the course of a biological survey of the Lloyd-Cornell Reservation near McLean, N. Y., made during the past summer, two species of this genus were collected, and the commoner one was represented only by females. Hundreds of nymphs were collected by Mr. C. K. Sibley and myself, and scores of these were reared in cages, and only females were found. As a nymph this species has long been known. I described and figured it in 1905 (as *Ephemerella sp.* N. Y. State Museum Bull. 86:45, Pl. 10). It is widely distributed in New York State. Since no males are to be had and there is no present prospect of obtaining materials for more adequately characterizing the species, it might as well bear a name, so I propose the name *Ephemerella feminina* for it. I note that Dodds, in describing a similar Ephemerella nymph from Colorado (Trans. Amer. Ent. Soc. 49:99, 1923), says of it "About thirty nymphs of this species in our collection include no males."

Little is known as yet concerning unusual life cycles in the Ephemerida. The ovo-viviparous habit of the European *Chlœon dipterum* has long been known (See Lestage, Larves aquatiques des Insectes d'Europe, Vol. I, p. 250, 1921). Recently Miss Helen E. Murphy, on dissecting out the eggs from the ovaries of a female of a South American Callibætis, discovered them to contain well grown embryos; wherefore, we named this new species *Callibætis viviparus* (Lloyd Library Bull. 24: 50, Pl. XII, fig. 154, 1924). It is probable than much remains to be discovered on more complete studies of the life histories of the group.

Cytologists who gather females of *Ameletus ludens* for the study of chromosome behavior in development need to be reminded that it is not necessarily and exclusively parthenogenetic.

The male may be described as follows:—

Ameletus ludens Needham.

Adult male: Length of body 8.5 mm.; tails 10.5 mm. additional; fore wing 9 mm.; fore leg 12 mm.

Head blackish, including the small lower division of the compound eyes. The large subspherical upper division of the eyes is honey yellow. Antennæ black.

The dorsum of the thorax is brown, with only small peripheral yellow markings around the humeri and on the metanotum. On the latter a pair of divergent pale marks is followed by a yellow U-mark in the rear upon the crest. In a side view the dorsum shines by reflected light with a golden metallic lustre. The thorax is black beneath except for narrow areas around the leg bases. The abdomen is brownish above, varied with paler on the middle segments at the ends. Beneath, the abdomen is whitish on the basal half. Middle and hind legs are brown; the fore legs, blackish, with one claw somewhat paler. Wings hyaline, with all venation black except at the extreme base. Tails blackish, becoming a little paler apically. Forceps black, tawny at the base, with extremely short basal segment, subequal terminal segments and the second segment much exceeding in length the other three taken together.

This is the smallest known species of the genus. Its nearest allied species is *Ameletus velox* Dodds (Trans. Amer. Ent. Soc. 49: 105, Pl. 8, fig. 17, 1923). The male genitalia differ from those of that species in the following points: the basal segment of the forceps is much shorter, being wider than long; the second segment is less cylindric, being constricted at its basal third and widened toward both ends; between the two triangular lobes of the plate beneath the penes there is a broadly rounded median notch; and the penes themselves are shorter and less incurved at the tips.

The unique male specimen is in the Cornell University collection.

NOTE ON THE HABITS OF *SPHENOPHORUS PONTEDERIÆ* CHTTN.

By D. H. Blake.

Bureau of Entomology, Washington, D. C.

In late August of 1924 the ponds of eastern Massachusetts were very low and in some instances dry because of a long drought. In two ponds in Stoughton and Easton beds of pickerel weed (*Pontederia cordata* L.) outside water level were brown and dying, while other plants nearby, although not any more supplied with pond water than the dying ones, were apparently healthy. Investigation showed that the dead patches of plants were heavily infested with larvæ, pupæ, and newly emerged adults of *Sphenophorus pontederiæ* Chttn. The thick rootstocks were completely hollowed out and rotten, and each plant contained several larvæ or pupæ. So disintegrated were these plants that when one took hold of the leaves and stalks they separated at once from the rootstock. The larvæ were most frequently found tunneling the rootstocks, but when they became mature they generally bored up into the flowering stem an inch or two above the earth to pupate.

In several stalks a dipterous puparium was found beside the remains of the larva, plainly a parasite of *Sphenophorus*. The adult fly that emerged has been identified by Dr. J. M. Aldrich as *Lixophaga variabilis* Coq. This parasite, closely allied to the parasite (*Lixophaga diatrææ* Tns.) of the sugar-cane borer (*Diatræa saccharalis* Fab.) has been reared in one instance, according to Dr. Aldrich, from *Lixus scrobicollis* Lec. at Dallas, Tex. In another case a carabid larva was found feeding on a pupa. Several carabid and staphylinid beetles also occurred suspiciously near the infested plants.

PROCEEDINGS OF THE CAMBRIDGE ENTOMOLOGICAL CLUB.

The meetings of the Club were resumed September 9, 1924. Mr. O. E. Plath who has studied the habits of bumblebees for several seasons reported many new observations made during the past summer.

Prof. W. M. Wheeler gave an account of the Barro Colorado biological reservation on an island in the Panama canal where he had spent part of the summer in company with Mr. Banks and Prof. Parker.

At the meeting of October 14, Dr. Joseph Bequaert told about his recent excursion to the Amazon river on the expedition conducted by Hamilton Rice, with several medical companions. Much of the country was under water but at Manaos and other landing places many interesting studies were made. Dr. Bequaert showed a dipterous parasite of a land-snail and a termite that excavates its nest in healthy and growing trees.

Mr. C. W. Johnson spoke of the large number of Diptera of several species on the salt-marshes and beaches of Gloucester, Mass.

Mr. A. P. Morse showed ends of branches of the blue spruce enlarged by the aphid, *Chermes cooleyi*.

At the meeting November 11, Mr. J. G. Myers gave an account of some little known Hemiptera from Panama. One of these lives in webs of spiders hanging among the outer threads like the guest spider Argyrodes. Mr. R. L. Schwarz spoke of a small moth from Texas (Meskea) which lives on plants of the mallow-family in gall-like enlargements of the stem. Mr. A. P. Morse exhibited the wingless female of the moth *Erannis tiliaris* of the linden tree and thirty males showing great variation in markings of the wings.

At the meeting of December 9, Mr. C. R. Kellogg of the Agricultural College at Foochow, China gave a lecture on the cultivation of silk in China which is still largely carried on by small farmers in the most primitive way. Mr. Kellogg is studying improved methods by which disease and parasites are reduced and larger yields obtained. Models of the common hand reel and many other implements used in sericulture were shown and some cocoons unwound.

Mr. A. P. Morse exhibited a dried chimney-swift from which the finer parts of the feathers had been entirely eaten away leaving only the quills. This was thought to be the work of Anthrenus.

PSYCHE

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